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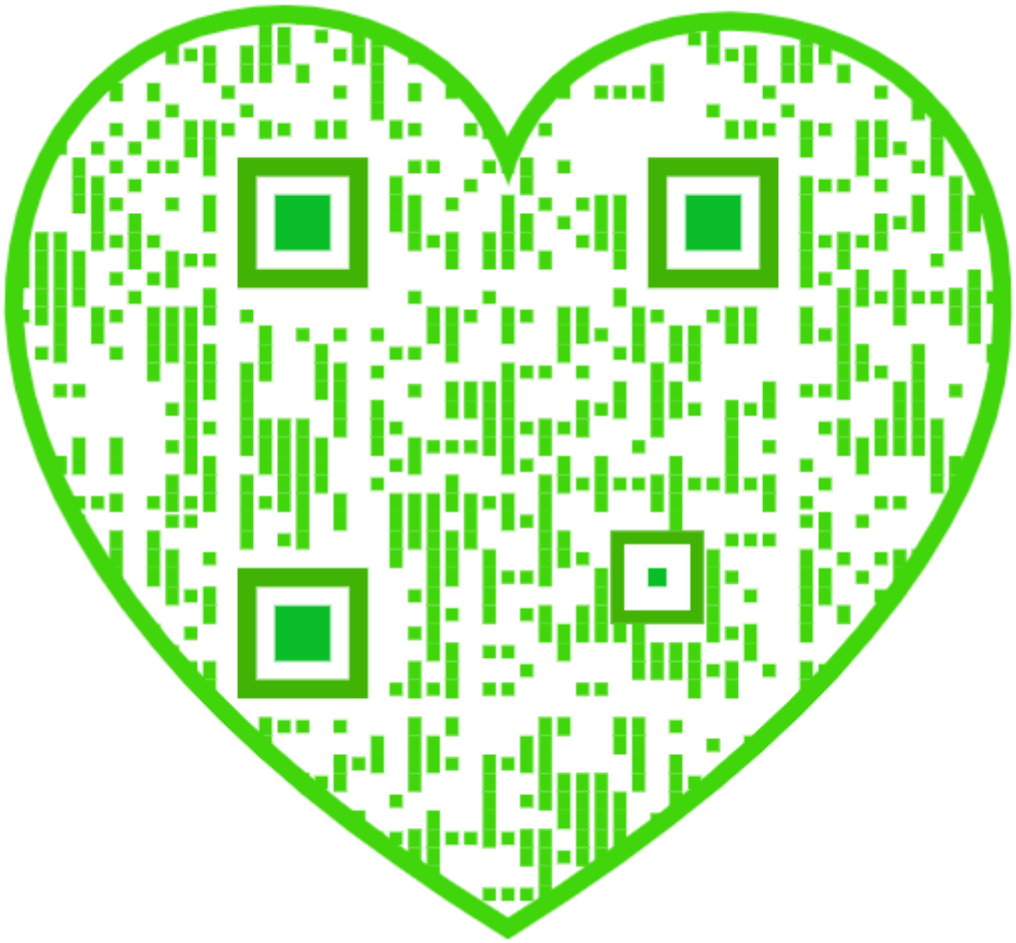

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TOWN SCAVENGING AND REFUSE DISPOSAL.

STREET CLEANING.

By Hugh S. Watson, A. M. I. C. E., London, England

THE methods adopted for the cleansing of the various classes of pavement are very similar all over England, but as each class requires a separate method it will be best to consider them in detail.

Asphalt, Wood Paved and Tar Macadam Surfaces in Towns.—Surfaces composed of these materials are the most easily cleaned, since they can be swilled down with water. The process is generally as follows: A water cart passes along the streets in order to damp down the surfaces, and so make it easier to collect the larger solid particles. A gang of men accompanied by carts then pass along and pick up the rough stuff, in order that there may not be too much solid matter to be removed by the subsequent flushing, as the whole of the flushing water passes into the sewers, so that if these precautions were not adopted there might be a risk of silting them up. After this has been done, the flushing is carried out by means of hose attached to hydrants. This is undoubtedly the most satisfactory way of dealing with streets subject to heavy traffic. The difficulty of sweeping up horse droppings which may have been passed over by heavy motor vehicles and may have become saturated with oil from them is very considerable, but the great pressure obtainable by the use of the hose pipes renders it a comparatively easy matter.

In London the water required for street flushing is obtained from the mains of the Metropolitan Water Board, the ordinary fire hydrants mostly being used as a means of supply. There are, however, several disadvantages to this arrangement, as it is necessary to notify the fire department of the London County Council when the hydrants will be required, in order that they may send an employe to turn on the water, and also to note the length of time during which the water is being drawn, as the water is paid for in bulk, the consumption being calculated from the pressure and the size of nozzle used. In order to avoid these inconveniences, some of the Metropolitan boroughs have special flushing hydrants, from which the water is drawn by their own employes, the consumption being registered by meter. The cost of the water is sixpence per 1,000 gallons. It is very difficult to make any comparison as to the cost of street cleaning by this method, as it depends entirely on the nature and extent of the traffic which passes over the roads.

Thus, in the city of London, which has an area of 650 acres, the quantity of water used during 1907 for night washing and flushing streets, courts and alleys was 77,424,000 gallons, and the cost £1,935, the number of nights on which the water was used being 303. The actual cost of flushing wood and asphalt paving is estimated at about 7d. per superficial yard per annum, for six nights per week.

In Sheffield the cost per superficial yard works out at about 4.02 pence for 200 times per annum.

As showing how the nature of the traffic may affect the cost, it may be mentioned that in Finsbury a gang consisiting of one nozzle man and four helpers can only clean about 600 lineal yards of road, thirty feet wide, equal to 6,000 square yards, in 9½ hours, while in Sheffield a gang composed of a turncock, a nozzle man and a helper can clean about 15,600 square yards in 7 hours.

The helpers are provided either with "squeegees" or brushes, with which they drive the debris into the gutters,

whence it is conveyed by the flow of water into the sewers or surface gulleys. If the matter is conveyed to gulleys, these should be emptied immediately the flushing has been completed. In many of the London boroughs the roads are swept down a second time in the early hours of each morning, the main cleaning being done from about 8 p. m. onwards, depending upon the district.

Asphalt, Wood Paved and Tar Macadam Surfaces in Outlying Districts.—In districts where they are not subjected to very heavy traffic, these surfaces can be cleansed more economically by rotary sweeping machines than by flushing with water, owing to the rapidity with which the machines can be driven.

The work is generally carried out in the following manner: A water cart is first sent along in order to allay the dust. The machine sweeper is then driven down the center of the street, and brushes the sweepings to one side, the brushes being placed at an angle to the axis of the machine. Each time the machines pass along they carry the sweepings a little closer to the edge of the road, and the process is continued until they have all been left in a long line down the side of the road, the exact number of journeys required to accomplish this depending upon the width of the road. These machines are very economical for cleaning asphalt, wood paved and tar macadam surfaces, as they are capable of cleaning about 8 miles of road, 30 feet wide, in 9½ hours, and only require the attendance of one man to act as driver. They are, however, unsuitable for roads having plain macadam surfaces, as the brushes tend to loosen and remove the binding material. As soon as the material has been swept into line, gangs of sweepers pass along on either side of the road and brush it into small heaps. Slop collecting wagons follow the gangs, and the material is placed in them and removed as speedily as possible. The sizes of the sweeper gangs will vary in different districts, depending upon the heaviness of the traffic over the roads. In the London districts it is found necessary to detail a ganger and six sweepers to every machine, whereas in Sheffield four sweepers have been found sufficient.

These slop collecting wagons are usually made to hold about 4 cubic yards of matter, but the exact amount that can be carried depends upon the state of the weather; in wet weather no more than 3½ cubic yards can be taken, while in dry weather as much as 4½ cubic yards can be carried, the average weight of a load being about 2 tons. It is not generally advisable to exceed this weight, as the strain put upon the horses becomes too great. With a 2-ton load and a journey of from 1 to 1½ miles each way, a cart is capable of taking about 4 loads per night.

In some towns, as in Leeds, the method is slightly altered. The machine sweepers are started about midnight and the sweepings are left in long lines at either side of the roads until about 6 a. m., so that any water may drain away. At this hour the cleaning gangs start to sweep the matter up into small heaps, and they are followed at 6:30 a. m. by the carts and horses, which remove the heaps prepared for them. The work is completed by 2:30 p. m. This system is unsuitable to the requirements of London, owing to the very early traffic in the neighborhood of the markets, and not only have the streets to be cleaned during the night, but during the winter months it is very often necessary to start shingling [sanding] the roads soon after 3 a. m. for the purposes of this traffic.

Macadam Surfaces.—Macadam roads are in all cases swept entirely with hand brooms. The process varies in different towns. In some cases the gangs are sent out each with its own cart or carts, as the case may be, while in others men are told off to clean different streets, and the carts make their rounds independently, collecting the matter that has been swept up. As in most large towns macadam surfaces are only in use in the outlying districts where the traffic is comparatively light, it is generally possible to do this work during the day-time. If the men are sent out in gangs, it is generally advisable to keep them small, having one ganger to every six or seven men, in order that they may be kept well under observation.

In Dover the town is divided into districts, and each district is swept by a gang of three scavengers with one cart.

The method adopted at Kingston-on-Thames is as follows: The town is divided into four wards, and the street cleaning in each ward is carried out by a ganger and four scavengers. The men are not allowed to work together in a batch, but are each given certain roads to clean, the basis being roughly one man per mile per day. By this arrangement Mr. Clucas, the borough engineer, considers that the men waste

less time in loitering than when they are sent out in batches, and there is no risk of any road being overlooked, it being the duty of the ganger to see that each man cleans the roads allotted to him. The men scrape the sweepings in to small heaps, which they leave at the roadsides, and collecting carts are sent around after each one to remove them.

In districts where the traffic is heavy it is preferable to employ young men for this work, as they are less liable to injury by passing vehicles than older men.

Cleansing of Courts and Alleys.—Courts and alleys are sometimes cleaned by flushing, but more often they are swept with hand brooms. This work offers very suitable employment for the older men, as they require less supervision than younger men, and if once made to understand what is required of them, can be entrusted to carry out the work in a satisfactory manner.

RESISTANCE TO WEAR OF MATERIALS FOR SEWER INVERTS.*

By Edward S. Rankin, Engineer Sewer Department, Newark, N. J.

IN examining brick sewers built 20 to 30 years ago it frequently happens that the bricks in the invert are found nearly or quite worn through. This is particularly noticeable in sewers with a fairly steep grade and carrying a considerable amount of street wash. I have in mind particularly one sewer about 6,000 ft. in length, built in 1873, where practically the entire invert has had to be renewed, a troublesome and expensive operation. The following quotation is taken from Folwell's "Sewerage": "A 5½ ft. two-ring brick sewer in Baltimore, 25 years old, was recently found with its invert in one place cut completely through for a width of 12 to 15 ins., and badly worn for a height of 2 ft. In Omaha's brick sewers the wear, which is usually 18 to 24 ins. wide, became 2 to 3 ins. deep in 12 years."

In order to avoid this trouble it has been our custom for a number of years past to line the lower third or quarter of the sewer with vitrified paving brick. The only test required for these paving brick in our specifications is that they shall not absorb more than 2 per cent. of their weight in water after being thoroughly dried and then immersed for 24 hours. Is this test a criterion of their wearing qualities in the sewer? And is the life of the sewer increased sufficiently to warrant the extra cost? Wiithin the past few years we have also built a number of concrete sewers, lining their inverts also with paving brick. The writer has heard the statement made that on some of the very steep grades in the city of Duluth sewers were found in which the brick was nearly worn away but the cement joints were left with almost their original thickness. If this is the case, is a vitrified lining necessary in concrete sewers? Another question along the same line is the relative wearing qualities of a concrete as compared with a vitrified pipe. The following experiment was made in the hope of throwing some light on the above questions.

The several samples selected were first tested for absorption and then placed on a rubbing bed such as is used in stone yards for smoothing blocks of stone. They were all given a uniform weight of 20 lbs. and were left on the bed for 30 minutes. The velocity of the bed on the line on which the samples were placed was 21 ft. per second.

The results are shown in the accompanying table. Numbers 1 to 4 were vitrified shale paving brick selected for their variation in absorption. No. 5 was a small shale brick made for use in sewers. Numbers 6, 7 and 8 are different makes of building brick also selected for their variation in absorption. Numbers 9, 10 and 12 were made from the mortar and concrete being used in the construction of a sewer at the time the experiment was made and were tested when 18 days old. No. 11 was a section of concrete pipe furnished by the Lock Joint Pipe Company of New York, and was approximately one year old. No. 13 was a tile used by the same company for lining their pipe where required by engineers. Numbers 14 and 15 were samples of vitrified salt-glazed sewer pipe.

*A paper before the American Society of Municipal Improvements.

The second column of the table, per cent. lost by abrasion, was obtained by dividing the weight lost on the bed by the original weight, assuming each sample to be of a uniform size, 2x4x8 ins. The last column assumes arbitrarily the life of the softest sample, No. 8, to be 10 years and calculating the others from this.

While this experiment is not to be considered by any means as giving absolute or final results, it appears to show, first, that for similar materials, although there is a considerable variation in the ratio, the abrasion in every case, with the exception of No. 12, increases with the absorption, and hence the absorption test gives a fair idea of the wearing quality of the material; second, the additional cost necessary to line the invert of a brick sewer with paving brick is certainly warranted, although the 2 per cent. test required by the Newark specifications seems unnecessarily severe; third, the concrete samples compare favorably with the paving brick, and it would therefore seem unnecessary to line a concrete sewer. The behavior of the mortar sample also bears on the statement as to ordinary brick wearing away faster than the cement joints. I am unable to account for the low figure shown by the stone concrete. The sample was made at the same time as Nos. 9 and 10, the stone being New Jersey trap rock. Fourth, the tile pipe is apparently not quite as durable as good concrete pipe, and the use of the lining tile is superfluous.

No.	Material	Per cent gained by absorption.	Per cent lost by abrasion.	Ratio of absorption to abrasion.	Life of invert in years.
1	Vitrified shale brick	1.36	2.00	1:1.47	324
2	Vitrified shale brick	2.15	3.35	1:1.56	193
3	Vitrified shale brick	3.60	3.42	1:0.95	189
4	Vitrified shale brick	4.28	5.92	1:1.38	109
5	Shale sewer brick	13.18	27.31	1:2.07	24
6	Building brick	7.39	20.41	1:2.76	31
7	Building brick	10.19	44.74	1:4.39	15
8	Building brick	18.91	64.74	1:3.42	10
9	1:2 cement mortar	11.86	4.41	1:0.37	147
10	1:2:4 gravel concrete	6.65	3.82	1:0.57	169
11	1:2:4 gravel concrete	5.10	3.35	1:0.66	193
12	1:2:5 stone concrete	7.40	8.62	1:1.16	75
13	Vitrified tile	1.34	4.47	1:3.34	145
14	Vitrified pipe	4.47	6.11	1:1.37	109
15	Vitrified pipe	1.72	4.55	1:2.65	142

THE WATER WORKS OF MARION, IND.

By Elkanah Hulley, Superintendent.

THE history of the water works of Marion, Ind., is typical of that of many of the water works plants of the smaller cities of the west. One has been prepared by Elkanah Hulley, superintendent of the works, whose family has been connected with the management of the works most of the time since the beginning. The following is abstracted from his history, for which, and for the accompanying photographs, we are indebted to Mr. Halley:

In the early days of Marion all the fire protection was by "bucket brigade," to which all residents, both men and women, belonged. It was not until the town had been visited by some serious fires that a Babcock fire extinguisher was purchased. In 1875 all the buildings on the west side of the square, between Third street and the alley between Third and Fourth streets, were destroyed by fire. And in January, 1876, all the buildings except one on the west side of Washington street north of Fifth street and south of the alley between Fourth and Fifth streets were burned. Then began the first real earnest agitation for a water works system, the late Samuel Hulley being the prime mover in creating sentiment in favor of it.

After considerable agitation a petition was circulated and signed by three hundred and forty-five citizens, representing five-eighths of the taxable valuation of the property of the town, and presented to the town trustees June 20, 1876, praying that a debt be contracted and bonds issued to the amount of $35,000 for the purpose of

WATER WORKS PARK, MARION, IND.

establishing a system of water works for fire protection and furnishing water for domestic purposes.

On August 23, 1876, an ordinance providing for the construction and for the issuing of bonds was passed. J. D. Cook prepared plans, the contracts were awarded on October 25 and November 7, and January 17, 1877, a lot was purchased upon which to locate the buildings and well.

September 29, 1877, Mr. Cook made his final report on the completion of the contracts, and called attention to the purity of the water and the ample supply from the well.

The cost of the plant to May 1, 1878, was as follows:

28,356 feet of pipe, with 26 valves, 40 hydrants, laid and set complete	$21,931.70
Engines, pumps, engine house and well	11,380.00
Boring well, grading lot, well house and all other incidental expense	1,394.65
Total	$34,706.35
Less material on hand	3,156.12
Net cost	$31,550.23

In August, 1880, the trustees purchased 4 lots and a tract of land in the southeast corner of the present water works park. In 1885 the board bought 5 more lots, extending the park north to Seventh street and west to Whites avenue, constituting the present water works park.

The first well contracted for was a dug well twenty feet in diameter and twenty-five feet deep, walled with brick. Sufficient water was not obtained at this depth, and two six-inch wells were drilled to a depth of about sixty-eight feet in the bottom of the dug well. After passing through an extremely hard hard-pan a fine flow of artesian water was secured in a water-bearing stratum of gravel.

This supply was sufficient for the needs of the town for a number of years. But a great deal of trouble was experienced from the gravel and fine sand choking up the casing of the wells. The water would rise to a height of about twelve feet above the surface of the ground, and was of an excellent quality.

As the town grew and a greater supply became necessary to meet the demands, a contract was awarded to the National Water Supply Company for sinking and connecting a series of six wells direct with the suction pipe of the pumps. These proved in most part a failure on account of fine sand getting into the pumps and choking up the Cook strainers on the bottom of the well casing. Many other wells were drilled, and all encountered the same trouble, and it was not until after the drilling of gas wells that the lower stratum of water was found in rock. The trouble then from sand and gravel seemed to be at an end.

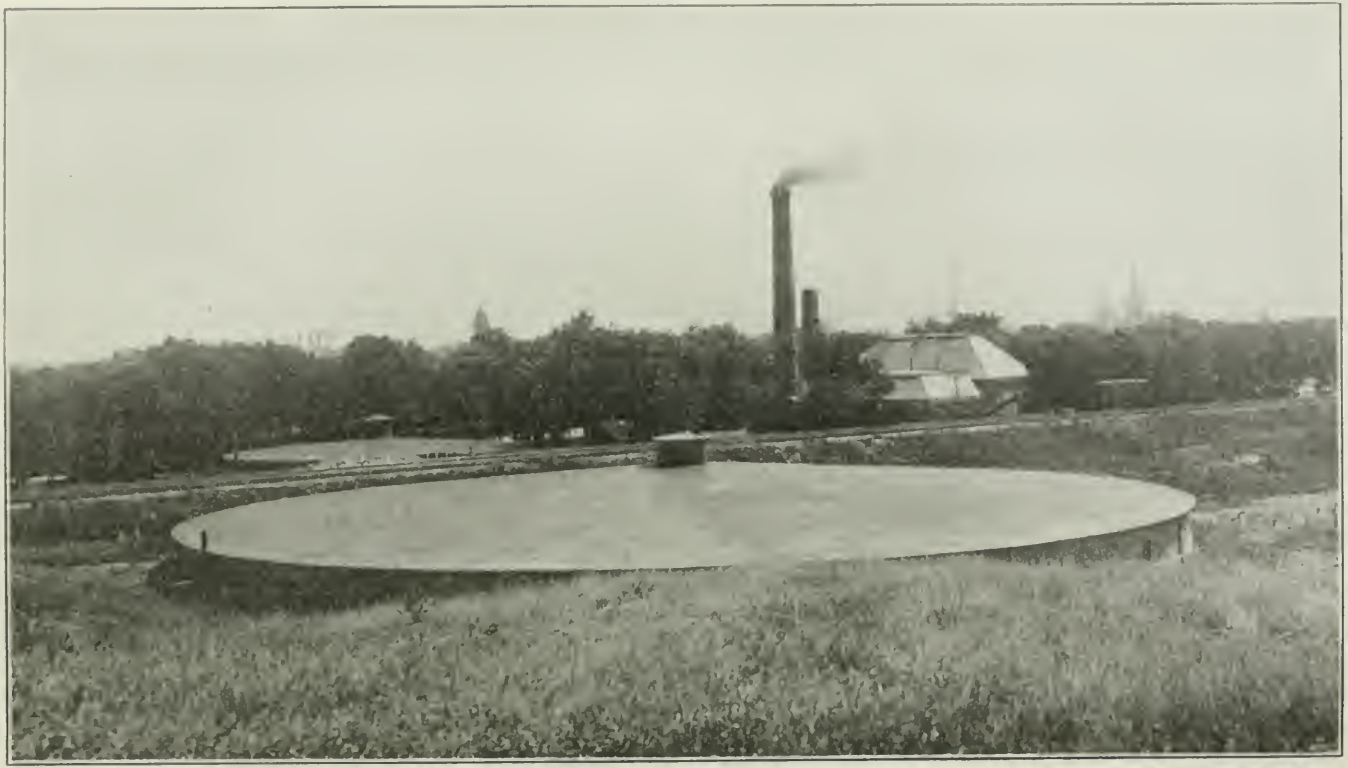
The first of the deep or rock wells brought into use was what is known as the Kiley well. This was secured at a time when the water supply was almost exhausted, and was a great relief. Following this a number of wells were drilled, some being pumped by air and others by deep well pumps. Nine wells furnished a sufficient supply until 1903, when well sites were leased from Asa T. Baldwin on Valley avenue, and a sixteen-inch pipe laid to convey the water by gravity to the pumping station. There are five wells now located on the Baldwin lease, making in all fourteen wells, which furnished an abundance of water during the summer and fall of 1908, which was the dryest season since the establishment of the water works. All the wells in use are drilled into limestone and the drift cased off with eight-inch casing, and are from one hundred and twenty to three hundred feet deep, and all are pumped by air lift.

The first pump installed was made by Dean Brothers, of Indianapolis, and had a capacity of 1,500,000 gallons in twenty-four hours, and was the only source of fire protection for the town until July, 1888, when the water works trustees contracted for a Dean duplex pump, with a capacity of 2,275,000 gallons, which was used as a reserve while making repairs on pump No. 1.

The third pump installed was a Fairbanks-Morse compound non-condensing, with a pumping capacity of 4,000,000 gallons per day, and was placed in commission in 1894, taking the place of pump No. 1. This pump was in almost constant service until July, 1902, and is now used as a reserve only.

The Fairbanks-Morse pump being the only one with sufficient capacity to be of service during a fire, the committee decided to install a larger pump and also an air compressor. The buildings being too small to house the new machinery, J. D. Cook prepared plans, and on April 30, 1901, contracts were awarded for reconstruction of buildings, pump and air compressor, laying water mains, boiler, and foundation for machinery.

The Snow Steam Pump Works in-



WATER WORKS PLANT OF MARION, IND.
Reservoir holding 2,000,000 gallons in foreground.

stalled a horizontal three-crank triple-expansion high-duty pumping engine, with a capacity of 5,000,000 gallons in twenty-four hours, which was put in operation in July, 1902, and has been in constant service without any expense for repairs on the engine or pump to the present time.

With the increase in population and the greater consumption of water, it became necessary to secure more wells and a means of pumping them. Previous to this time deep well pumps had been used for this purpose, but as the new wells were located further from the plant, it was decided to purchase an air-compressor, and in June, 1895, a contract was entered into with the Hall Steam Pump Company, of Pittsburg, for a 16x20x18-inch air compressor, which, with the deep well pumps, were used until July, 1902, when the present Laidlaw-Dunn-Gordon 15x25x20 x24-inch cross compound machine was installed by the Bacon Air Lift Company, which took the place of the first compressor and all the deep well pumps, and is now pumping fourteen wells. While pumping water with air lift is expensive, this machine has given entire satisfaction and has cost practically nothing for repairs in the six and one-half years it has been in service.

Three changes in boilers have been made since the installation of the plant, each time with an increased horse-power capacity. At present there are one 300-horse-power Stirling water tube boiler and two 66x18-inch tubular boilers with 6-inch lap-welded tubes, the latter boilers being used only while cleaning the former, which has been in service seven years and is reported by the boiler inspector in first-class condition.

Reservoir or well No. 1, 25 feet deep and 20 feet in diameter, was the dug well contracted for by Dean Brothers in their original contract. It has a holding capacity of 58,900 gallons. The suction pipes from the pumps are connected to this well, and the water from the other reservoirs is brought into it by gravity.

Reservoir No. 2, 13½ feet deep and 53 feet in diameter, will hold 224,000 gallons, and was constructed in 1891. It was considered of ample capacity for all purposes at that time, but as the population increased L. M. Overman, city engineer, prepared plans for reservoir No. 3, which was constructed in 1896. This reservoir is 15 feet deep and 94 feet in diameter, and has a holding capacity of 750,000 gallons.

The consumption became greater than the capacity of the wells in the day time, and it was often necessary to draw on the reserve to such an extent that had a fire broken out it would have been taxed to the limit and possibly exhausted.

This fact being evident, City Engineer Thomas E. Petrie prepared plans for reservoir No. 4, and the contract was awarded on September 5, 1905, at $10,400. On July 9, 1906, the contract for the roof was awarded at $3,750. Its location is on the south side of the P., C., C. & St. L. railroad and the crossing of Whites avenue. It is 16 feet deep and 152 feet inside diameter, and has a holding capacity of 2,000,000 gallons, and is fed by two wells in such a way that the water is in constant motion. The overflow is taken from the bottom, and the water is practically changed every eight days.

All the reservoirs are covered and kept under lock and key, insuring a pure, clean supply of water.

Summary of receipts and expenditures since the installation of the plant to February 10, 1909:

Received from tax levy for payment of bonds, interest and extensions	$197,336.80
Total receipts from water rents	332,592.85
Total receipts	$529,929.65
Applied on payment of bonds issued and redeemed	$84,000.00
Interest paid on bonds and loans	54,752.50
Applied on extensions	180,661.89
Applied in operating and repairs	202,611.36
Cash on hand Feb. 10, 1909	7,903.90
	$529,929.65

The cost of the plant is as follows:

Bonds issued and redeemed	$84,000.00
Interest paid on bonds and loans	54,752.00
Received from taxes applied on extension	58,584.30
Water rent receipts applied on extension	122,077.59
Outstanding 4 p. c. bonds	38,500.00
Total cost	$357,914.39

The water works plant is entitled to the following credits for service and cash for which it has received no returns:

Water rent receipts applied on extensions shown above	$122,077.59

WATER WORKS PARK, MARION, IND., IN WINTER.

Saving to city in hydrant rentals over private plant at $55 each per annum...	290,400.00
Saving to consumers of 56 per cent. lower rent than if owned by private company	186,251.99
Seventeen years free water to city light plant, $75 per year	1,275.00
	$600,004.58

Free list for which credit has not been taken: Fourteen school buildings, city library, all of the churches, Young Men's Christian Association, Emily E. Flinn Home, five fire stations, seventeen drinking fountains, city hall, water for street cleaning, water for building streets and sidewalks, sixteen automatic flush tanks for sewers.

In arriving at the saving to consumers in water rentals, the average of twenty cities in Indiana, with private water plants, was taken, and, based on a dwelling of six rooms, with house use, bath and closet, was found to be, average, $13.26; Marion, $8.50. For house use only, average, $5.93; Marion, $4.

Average meter rate per 1,000 gallons in twenty cities as above: Maximum, 30 cents; minimum, 10 cents. Marion: Maximum, 15 cents; minimum, 6 cents.

Number of consumers: Flat rate, 2,808; meters, 492; hydraulic elevators with counter, 2.

Water rent receipts have increased from $21,336.53 in 1903 to $28,513.20 in 1908. The total for the six years is $152,993.19, which has been applied as follows:

Transferred to extension bond and interest fund...	$68,639.99
Operating, repairs and salaries	77,608.10
Cash on hand.....	6,745.10
	$152,993.19

The average pumpage of water has increased from 1,306,799 gallons a day in 1903 to 1,547,849 gallons in 1908.

An inventory of the plant shows a total valuation of $282,440.40.

Size and number of feet of distributing mains are as follows: 20-inch, 696 feet; 16-inch, 1,320 feet; 12-inch, 1,650 feet; 10-inch, 9,284 feet; 8-inch, 6,305 feet; 6-inch, 156,690 feet; 4-inch, 30,788 feet. Total number of feet, 202,733.

The water works plant is self-sustaining, the income meeting all expenses of operating, payment of bonds and interest, and making extensions.

GAS AND ELECTRIC COMPETITION ABOUT BOSTON.

By Alton D. Adams, Worcester, Mass.

CONSOLIDATIONS just authorized by the gas and electric light commissioners, of Massachusetts, will promote gas and electric competition about Boston.

Under a decision of the commissioners dated August 20, 1909, the Edison Electric Illuminating Company, of Boston, is authorized to purchase the electric locations and properties of the Boston Consolidated Gas Company, the Newton and Watertown Gas Light Company and the Waltham Gas Light Company, used in the business of generating and furnishing electricity for light and power.

The Newton and Watertown Gas Light Company is by the same decision authorized to purchase the gas franchise and property of the Waltham Gas Light Company.

By these purchases the service area of the Boston Edison Company, which now includes most of that city, besides Somerville and Woburn, and twenty-two towns, is extended over the Back Bay and Brighton districts of Boston, the cities of Chelesea, Newton and Waltham, and the towns of Brookline and Watertown.

The Newton and Watertown Gas Light Company will extend its gas supply over Waltham, and there is pending before the commissioners a petition for the consolidation of the East Boston and Chelsea gas properties, this consolidation being contingent on the approval of the Edison purchase of the Chelsea electric property.

For the electric property and locations of the Boston Consolidated Gas Company the Boston Edison company is to pay $1,300,000; for those of the Newton company, $500,000; for those of the Chelsea company, $350,000, and for those of the Waltham company,

$600,000. The Newton company is to pay $500,000 for the gas franchise and property of the Waltham company.

Material reductions in electric rates are to follow these consolidations, for the maximum net rate of 12 cents per kilowatt hour now charged by the Boston Edison company is to apply at once over the added area, and this rate is to be lowered to 11 cents per kilowatt hour not later than January 1, 1910.

The present maximum net rates of the several purchased electric plants are as follows, per kilowatt hour: Boston Gas Company, 14 cents; Newton company, 12 cents; Chelesa company, 15 cents, and Waltham company, 16 cents. Tho Newton rate was reduced from 18 cents in anticipation of the sale to the Boston Edison company.

In Newton and Waltham the gas rate is to be reduced from the present price of one dollar to 95 cents per thousand feet, on or before January 1, 1910. It has been further stipulated, though this fact does not appear in the above opinion of the commissioners, that if the East Boston and Chelsea gas companies are permitted to consolidate, per their pending petition, the net price of gas in the area supplied by these two companies will be reduced from the present rates of $1.00 and 95 cents to 90 cents per thousand feet, on January 1, 1910. More than this, the company will, on January 1, 1911, take up with the commissioners the question of further change in the rate.

Among the reasons given for their decision in favor of the above consolidations the commissioners say:

"In the light of the progress which has already been made both in the gas and electric business, it is clear that gas and electricity can be profitably supplied over far wider areas than was formerly thought feasible. It is equally clear that greater efficiency in operation and greater economies in investment and operating costs are possible in a large gas or electric plant serving a given territory than to several independent small plants serving different sections of the same territory. Experience also indicates that there is a public advantage in communities of the size of those now under consideration in having the gas and electric business separately conducted and under independent management and control. The two kinds of business are so far competitive that the natural rivalry between the two is stimulating to both managements, and should result in substantial benefits to the public."

"Compared with that of the Edison company, the electric business of all the others named is small in volume, less varied in character and transacted at substantially higher prices. When the volume and character of the business of these companies are considered, it may safely be assumed that the Edison company can readily supply electricity in the several territories of the other companies at lower costs and charges than any of these companies could reasonably be expected to do."

While gas and electric properties are being consolidated in many parts of the United States, it is especially worthy of note that just the opposite process is going on in eastern Massachusetts.

THE CARE OF SURFACE WATER AT STREET INTERSECTIONS.*

By S. D. Newton, City Engineer, Knoxville, Tenn.

ONE of the most serious problems with which the street builder has to reckon deals with the care of water at intersections. Failure to adequately provide for storm water may easily cause overflows onto adjacent property and entail damage suits against the city for sums which in extreme cases may equal or even exceed the original cost of building the street. Water standing for any proportion of the time upon the street surface will cause deterioration in the material of which the surface is constructed. With a bituminous street such deterioration is accomplished in a comparatively short time; with a wood block street, unless most thoroughly impregnated with creosote oil, decay may be more rapid still; while even with a stone, brick or concrete street standing wa-

*A paper before the American Society of Municipal Improvements.

ter is apt to get into small cracks, undermining the pavement and in winter time freezing and breaking up the base. Even if the street is fully drained, it may be that the inlets are so placed as to occasion considerable streams of running water directly opposite the ends of the sidewalks, causing great annoyance and perhaps disrespect as regards the engineer on the part of pedestrians. Nothing connected with the city engineer's duties is so fruitful of criticism on the part of the general public as this one point. It is true that these criticisms are often unreasonable, but nevertheless they are made, and should be guarded against as much as possible. Finally, the general appearance of the street is in large measure governed by the drainage problem; an otherwise excellent street design may be entirely ruined by improper and awkward appliances for taking care of and carrying away surface water from intersections.

The problem is varied, and no hard and fast rule can be laid down for its solution. No two street intersections are exactly similar, and especially in hilly towns, such as the one I have the honor of serving, the handling of one intersection can never be taken as a criterion for the proper disposal of the next. A catchbasin location which would be entirely right and proper on a gentle slope may be left high and dry by a stream of water rushing down a 10 per cent. grade. In general, however, street intersections may be divided into three distinct classes as regards their drainage: (1) those in which all grades lead away, or, in other words, where the intersection is on a summit and where, of course, the amount of water collecting is so small that no provision need be made for caring for it otherwise than in the proper crowning of the street surface; (2) those in which all grades lead to the intersection and where it is imperative that the storm water be taken underground; and (3), including the great majority of cases, those where part of the grades lead to the intersection and part away. In such instances it is sometimes a question whether to take the water underground at the self-draining corners or to allow it to take its natural course down the gutter. If the intersecting street is unpaved and on an ascending grade, the water should be taken care of otherwise than on the surface in order to keep trash and dirt from being washed down from the intersecting street and being deposited upon the surface of the paved street. If, however, the water flows from a street already paved in not too great a quantity, and if the grade of the gutter down which it naturally flows is heavy enough to take care of it without inconvenience or overflow, the corner can generally be allowed to drain itself. In my practice I endeavor never to allow water to flow in the gutters for more than six or seven hundred feet, as the volume of flow for a greater distance than this is, during heavy rains, enough to be annoying to pedestrians.

The remarks which follow are based upon the assumption that separate sewers are provided to take storm and sanitary drainage. With a few exceptions, however, they apply equally well to the problem in cities having the combined system, it being understood that in such cases all openings into the sewer must be securely trapped to prevent escaped of sewer gas.

A paved street should, if possible, be well drained by storm water sewers, but occasionally the engineer is called upon to pave a street where either the outlet for a proposed storm sewer is so remote as to make the cost prohibitive or for some other reason it is impracticable to sewer some portion of the street; in such cases it is necessary to provide some other expedient wherever storm water has to be carried across an intersection, and to do so is sometimes a quite perplexing problem. Several ways have been suggested, but the ideal one is yet to be found.

Valleys across an intersection designed to carry the water on the surface are unsightly, a perpetual annoyance to drivers and "carriage folk," invite deterioration of the surface, and, with swiftly moving fire apparatus or in winter time, if clogged with ice and snow, they may become very dangerous. They should be avoided whenever possible, and, if used at all (except at alley intersections where they are perfectly legitimate), they should be placed across very unimportant and lightly traveled streets only, and where they can be made with as light a depression from the normal as possible.

Culverts, with stone or concrete bottoms and walls and cast iron coverings, have been used quite extensively, but the practice should, in my opinion, be discouraged, because they are very expensive both in first cost and in maintenance, the cast iron plates being apt to break under heavy loads or sudden jars; because they are danger-

ous and afford places on which a horse is liable to slip, especially in wet or frosty weather; because they are unsightly; and because it is necessary to flatten and distort the surface of the street to meet them.

I have known of the use, in a few instances, where no better solution presented itself, of culverts with cast iron covers sunk below the finished surface of the street and carrying the regular street surface over them. Such culverts are, in my opinion, not as unsightly as if the cast iron plate were exposed, since the regular crown of the street formed of the ordinary paving material can be carried across them, nor are they more slippery than any other part of the street, but, on the other hand, they are even more expensive than the others, and they are wasteful of head room, calling for deep gutters at either end, and presenting, besides, a ragged appearance when viewed from the gutter or curb.

In many cases a cast iron pipe can be placed in the intersection with the top sunk slightly below the finished street surface, using a "Y" and a branch in cases where water reaches the intersection from two ways. This form of construction is cheaper than the culvert construction, but, as before, a deep gutter is necessary on either end, and the pipe is liable to become clogged with trash or ice and snow unless of considerable size. In my experience no pipe less than twelve inches in diameter will keep itself clean when carrying storm water even although it drains a paved street.

In several instances I have placed sections of storm sewer at the usual depth below the street surface, equipping them in the regular manner with inlets and catchbasins and running them out on a lighter grade than the intersecting street to an intersection of the flow line with the gutter surface. This is confessedly a temporary expedient, to be used only where the intention is later on to carry out the storm sewer to a proper outlet, and where the intersecting street is on a considerable grade. This form of construction is particularly useful when the street being improved skirts along the side of a hill and the intersecting streets will eventually have to be paved also. In such cases it is, I think, the best form of construction possible for the time, although it is open to the objection of affording a very ugly outlet where the sewer pipe comes to the surface in the gutter. It is best to use a section of iron pipe at the lower end, as a line of vitrified clay pipe when uncovered is very easily broken up by wagon wheels striking against it.

If the intersecting street is likely to remain unimproved for a number of years, it would perhaps be best to end up the sewer in a box covered with a cast iron grating, inclined at slight angle to the street surface, as thereby the exposed depth of the gutter can be lessened and brought more nearly to the normal. This grating should be removable, however, for convenience in cleaning, which it will require quite frequently, as it will be a very effective stop for any waste paper or trash which may find its way into the pipes.

When sewer facilities are provided, the problem resolves itself into a question of the design and proper location of the storm water catchbasins and inlets.

In regard to the design of the inlets, the principal points to be borne in mind are to provide sufficient opening to carry the water from the street surface to the sewer without unduly obstructing travel on the street, to so arrange the opening or openings that they will not be easily clogged up with trash washing down the gutters, and to avoid a pool of standing water in the basins. A great many engineers provide for settling basins by raising the outlet into the sewer some inches above the bottom of the pit, the idea being to catch trash and debris and to prevent it from entering the sewer, but, in my opinion, this is bad construction. As our street cleaning departments are usually organized, it is next to impossible to keep our catchbasins cleaned, and this pocket simply affords a trap where street washings rot and disintegrate, and where stagnant water settles and breeds mosquitoes on a wholesale plan; in other words, it is an invitation for filth and disease. It is much better, in my opinion, at least in towns where the average sewer gradient is high enough to afford easy drainage, to let everything that gathers in the gutter pass on into the sewer as quickly as may be. I sometimes regret that it is not possible to build "fool-proof" sewer systems, for not otherwise, until our street cleaning bosses see a great light, is it possible to keep our drainage systems operating at full capacity; it is indeed discouraging to plan a storm sewer and accessories according to the needs of the neighborhood, and then have it entirely neglected until it becomes so clogged that a heavy storm causes overflows onto adjacent property. The point I wish to make is that where the outlet pipe is placed at the bottom of

the basin there is not nearly the liability for unsanitary conditions, but even in such instances I have known catchbasins to fill up to the street surfact with sticks and stones within a few months after they were built. A small amount of care intelligently applied would have kept them operating nicely. What is in some respects a still better form of construction does away with the catchbasin entirely, ending the sewer branch in a 90 degree bend turned up, and building the inlet directly over this. However, if this is done, frequent manholes have to be provided to give access to the sewer for purposes of flushing or the like.

There are many designs of inlets in use—some better and some poorer; none fitted for universal use, and some not fit for use at all. A very common design is the grating fitted into the street surface. This works very well until it becomes clogged with waste paper or leaves, at which time it refuses to act at all. There are instances, however, as in alley openings, or where the gutter is placed in the center of the street, that it is the only style possible to use. Its catching capacity when clogged can be improved somewhat by depressing the surface an inch or more in the center or next to the curb.

A better form for general use, because not so apt to become clogged, is that known as the concealed inlet, located in the curb, leaving the street surface unimpaired. It is open, however, to the objection that it is generally necessary to place a manhole back of the curb to provide a way to clean it out, which is unsightly and may become a menace to public safety. Likewise, on steep grades, the water is likely to rush by it without entering even when the street surface is sloped quite severely toward it.

Our Knoxville standard combines these two styles of inlets. It consists of a grating in the street surface, depressed to the curb, in connection with an inlet in the concrete curb formed by embedding an iron plate in the concrete two or three inches above the finished street surface and carrying the curb across on top of this plate. A curb joint is provided at either side of the basin to guard against uneven settling as between the catchbasin walls and the ground beyond. The grating frame is removable, doing away with the necessity for a manhole in the sidewalk. This standard was adopted last spring and has been used this season only, so that it is yet too early to tell much as to how it will work out in the long run, but it promises well.

Where an intersecting unimproved street is on a heavy downward grade, the best and almost the only way to catch the water is by building an inlet squarely across the gutter, a short distance above the intersection, giving an unimpeded fall directly from the gutter into the basin. Such an inlet can best be covered with an iron plate.

The engineer should study closely the locations of his inlets so as to make them perform the most efficient service. Usually it is best to locate them above the cross walks so as to keep that part of the intersection used by pedestrians as dry as possible. Where, however, two descending grades meet, one frequently has a space difficult to drain lying below and between the two inlets when so located. If the grades are very light it may be possible to drain this space by showing a very small face on the curb at the center of the turn and sloping the street surface back in either or both directions, as is most convenient, to the basin. It is frequently necessary, however, to locate an inlet directly on the turn. If but a small amount of water congregates at the point, the gutter stream may not be so wide opposite the ends of the walks but that a person can easily step across. If, however, some protection for pedestrians is necessary, one of three alternatives can be resorted to. Probably the best form of construction, in this case, although calling for a higher first cost, is to locate three inlets—two above the cross walks and one on the curb turn; or, the gutter may be built with vertical sides, and the street surface made to conform. The two walls of the gutter must either be brought close enough together so that a child can step across and the gutter be left open, or else the space between may be made wider and bridged with a cast iron plate. Either form of construction affords some obstruction to street traffic, and is not to be recommended where it can be avoided, although in some cities the former arrangement may be seen at the majority of the street corners. The practice of placing a series of cast iron plates for the whole length of the curb from property line to property line makes an extremely ugly, awkward and expensive corner, and should be resorted to only in very exceptional cases.

STREET LIGHTING.

By Dr. Lewis Bell.

I need hardly say that it gives me great pleasure to meet the society at this second annual convention. But it is not for the purpose of obvious congratulations in the gathering that I arise now, but rather for the purpose, if I may put it so boldly, of bringing before you reasons for repeating the cry of Ajax for "more light."

Unfortunately, we, in these times, can only call for more light—we have not the privilege of Joshua in holding the sun and the moon still to provide it for us. Things were done in a better way in the olden times, they have always said.

The topic which I wish to bring before the convention definitely, then, is the topic of street lighting—some of the things which underlie it, some of the things which are needed to make it sound in practice as well as in theory.

Man is becoming more and more a nocturnal animal. It was not more than two hundred odd years ago, perhaps about the time that Philadelphia was founded or a little later, that the first attempts at systematic street lighting were made. One has but to consult the evidences of old books and old prints to see very plainly that our ancestors and contemporaries of the founders of Philadelphia had very little to show in the way of public lighting. A candle flickering in the wind near a window, a horn lantern casting a feeble glimmer down the street and dribbling oil on the passers-by, and a pine knot or a flambeau of asphaltum, borne by a torch-bearer hurrying through the crowd and thrusting his smoky weapon in the faces of the passers-by—these were about all that the world could boast of in the way of street lighting two hundred or two hundred and fifty years ago.

The activities of men are so far transferred from day to night at the present time that it becomes absolutely necessary to make provision for those who are traveling about after nightfall, and for the general business that is carried on at night—business of the theaters and concerts, and business of people hurrying from one place to another in the ordinary routine of their day's work extending until after sunset. For all of these purposes light, and plenty of it, is necessary, but this light we have only to a rather limited extent in most cities.

The fundamental criticism against most attempts at street lighting lies not in the illuminants used, nor in their application, so much as in an improper adjustment of the illumination to the needs of the city. Street lighting has been a growth and an evolution, but, like all growths, it has proceeded to a certain extent along the lines of least resistance.

The result is that, looking over a city—particularly an American city—however good the intention of the city government, however excellent the technical skill of those who furnish the light, much is still left to be desired. The difficulty lies in the fact that the illumination is spread out too thin, so to speak. We do not carefully discriminate between streets, the nature of the usage of which demands considerable light, and those streets which are perfectly well illumined with a less quantity of light. We attempt to follow out the general American theory that all men and all things are free and equal, and distribute a very finite amount of light over a very large area, with some approximation to uniformity, lest we hurt the feelings of our good fellow citizens by insinuating that Z street does not carry the heavy traffic and is not so crowded with by-passers in the evening as A street. In point of fact, we all know, in going through a city, that there are certain great avenues of evening traffic, certain places where light is needed all night, and every night, and a great deal of it. The commonest failure is the failure to recognize this simple fact, and in attempting a certain degree of uniformity, never exact uniformity, of course, which is quite improper when one considers the use to which the various streets are put.

There should be what there generally is not—a very careful adjustment of the resources of the city in the matter of lighting, so as to facilitate the greatest possible amount of the evening traffic. This means that in streets which are largely used during the evening illumination commensurate with their importance should be used, but for streets where the night traffic is light, and where passers-by are few, only light enough is needed to enable the people to get about comfortably. There is still a third class of street which needs individual treatment, sometimes gets it and sometimes does

not, and that is the outlying street—the merely suburban road—the country road which still comes within the province of the municipality to illuminate. In places of that sort funds are seldom available for providing anything like serious illumination, but a great deal for the convenience of the public can be done.

The purpose, the fundamental purpose of lamps in these outlying, little-used streets, which yet need some light, is merely to serve as markers of the way; in other words, in these unfrequented places, streets where illumination of the first order is unnecessary, and that of the second order needlessly great, the important thing is so to distribute the light that the illuminants serve to mark the way and clear the passage for the passers-by. In such places the somewhat common practice of using very large units of whatever kind is obviously improper. One marker a mile of 1,000 candle-power is not anywhere nearly so good as half the amount of light put out at short distances in smaller units; in other words, where a lamp is used merely as a marker to show the way, and a general illumination cannot be undertaken, the best thing is to employ small units and locate them so as to get the best results obtainable from the energy in whatever way it may be applied.

There are, then, three distinct classes of streets which must be considered in the problem of the theoretical character and practically useful illumination. First there are the chief streets—the heavy arteries of traffic which need all the light they can get. Then there are the secondary streets, making up the bulk of an ordinary city, which need to be well lighted, but do not require a blaze of illumination, because they are used in an entirely different way from the main streets. And finally there are the tertiary streets, in which the lighting is intended merely to show the way.

In our ordinary practice here these classes run into each other by such gradual transitions that one can hardly tell whether there was any fundamental idea in the minds of the persons who laid out the streets or not. Our chief streets, as a rule, all over the country, are really poorly lighted, the secondary streets not particularly well lighted—sometimes a little better than they should be, and sometimes not quite so well—and the tertiary streets frequently rejoice in one illuminant every long block, useless for practical purposes except within a very short radius, and utterly failing, too, in the proper marking out of the way. As regards the absolute amount of light required, there will be always difference of opinion. In the principal streets, where the traffic is constantly heavy, I think that one would not go far wrong in following the principle that one should have light enough to see to read a paper by. I would not recommend the citizens to sit out on the curb and read their evening papers, but I think the chief streets of the city should be always so well lighted that if any one must consult a note-book to find his way, or wants to refer to a letter for any purpose, he should be able to read it without having to walk a half block to get under the nearest lamp. As to the secondary streets, much less amount of light than that is desirable, and not so much is necessary, in fact. The tertiary streets can use a still less amount.

In connection with this matter it is noteworthy that the foreign practice in England and on the continent is to provide in the different streets light enough to read a paper by. This summer I traveled miles through the chief streets of the European cities, and was able to read the fine print of a Baedecker every foot of the way by the light of the streets lamps alone. That is the ordinary standard of goodness which is lived up to in the large foreign centers.

In actual amount the London canon in lighting calls for an average of something like a quarter of a foot-candle, as against one-tenth or one-twentieth in the ordinary American city. The secondary streets on the side use about the same value of illumination as the ordinary street here. The tertiary streets are still less lighted, perhaps half as much, but the light is invariably secured by comparatively small units, either gas or electric, instead of putting up very big units. So much for the general design of the illumination.

Now as to its matter. In the first place, whatever the intensity adopted, it is desirable to have a fairly uniform distribution. By that is not meant uniformity at the expense of low maxima, but it is undesirable so to scatter the lamps as to have a great deal of light here and there and none between. Secondly, it is desirable to diffuse the light so as to make it as useful as possible. One of the great points of difference between the practice here and European practice is that diffusing globes are practically in universal use except in the United States; and therefore there is less uniform lighting here than

almost anywhere else. Merely, if for no other reason, because the light is not diffused, the illuminants themselves are of a different character, are intensely brilliant, and the result is a certain dazzling effect which very much decreases the practical usefulness of the light, on just the same principle that a bare lamp in front of one's eyes is a very inconvenient thing.

In the matter of distribution one cannot sacrifice too much for the sake of uniformity. It is a fact which one will find out readily by observation that one can light a street uniformly and yet badly. There can be a fairly good minimum on a street, and yet it may be lighted badly for the purposes of a chief street. It may be well to mention two places that I have visited. One is a place in Paris where there is a tremendous concentration of illuminants. All of the units are small and massed together, massed in a way that would show, if one deliberately sat down and figured the illumination, a result which would cause one to feel proud of it. Practically, however, the place is badly lighted. There is no effort of brilliancy; one can see fairly well all about, but the place is nevertheless insufficiently lighted.

I call to mind another place in Berlin where the average intensity is probably not very much higher—not more than 50 per cent., perhaps, where the units used are of the same kind, but of very much greater intensity. The effect is beautiful. In other words, one can dwell neither on the minimum in the street as a canon of good lighting, nor on the average as seen along the street. One must bear in mind that a big center of light, throwing an immense amount of light out into the street and being reflected from the house, adds a great deal to the efficient illumination of a street for the purpose for which street illumination is desired. One can get fairly uniform lighting, and he can take the same amount of power and get less uniform lighting which will be quite as effective. In other words, one must look at the thing as a practical matter, and not as a mere theoretical matter of so many hundredths of a foot-candle. It does not take an expert in illumination to see whether a street is badly lighted or not, and it does not- consequently, take an illuminometer, with measurements in the thousandths of foot-candles at the half-way distance between the lamps, to show that improvements are necessary. The thing is a strictly practical matter, and should be treated as such.

That brings up the question of the direction of measurement—how shall we measure the light on the street? The customary measurement in this country is a tacit apology for bad lighting. The customary method of measuring here is a measurement practically half way between the lamps with the photometer disc, or other measuring instrument, held normal to the ray. If one gauges his illumination solely by such readings as this, he can be guaranteed a badly lighted street in every case, because the tendency of competition, from whatever souce it comes, is to secure that minimum at as low a maximum as possible, modifying the illuminants to be as useless as possible, subject to the condition of getting the low minimum, and the result is a badly lighted street. I could mention types of illuminants which have been deliberately specialized for the purpose of giving two-hundredths or three-hundredths of a foot-candle, at some point down the street, whereas if the same illuminant were designed, not to give a special form of illumination, but to give the best efficiency of which it was capable, it would not only be possible to make it light the distant parts of the street, but the whole of the street; in other words, there are cases in which the efficiency is deliberately sacrificed for the sake of what is nothing more or less than bad distribution.

Every effort toward economy should be an effort directed to increase the total flux of light, because with our modern illuminants this is chiefly to be taken into consideration for street lighting.

There is no excuse to-day, whatever there may have been ten years ago, for specializing distributions by means of the design of the illuminant, because, at the present time, it must be shielded. One can both distribute and diffuse light at the same time, and, what is more important, when a street is lighted on any adequate scale all spherical distribution obtainable is needed.

The foreign practice in the matter of direction of measurement is to measure the illumination as it falls on a plane four feet above the ground, measuring on the horizontal, and thus measuring the resolved component. One-tenth of a foot-candle so measured very obviously means a great deal more than the tenth which is obtained on the normal measurement.

One is sometimes tempted to wonder on what basis this particular measurement on the horizontal was chosen and why the thing has not been more fully discussed. It has not been more fully discussed here because people do not like to talk about that little resolved component. It is so much nicer to talk about the larger normal. It is not discussed abroad with any great vigor, simply because in the first place the light is sufficient to give a thoroughly adequate measurement on the horizontal, and second, because, as a matter of fact—it happens to be a rather curious one, too—the lamps in England and on the continent are customarily placed at just about the point that makes it a matter of indifference to them which way they are photometered. That is to say, in measuring the illumination on the horizontal plane, one measures the effect from two lamps. In measuring on the normal the effect from only one is obtained. Now, at the distance and height at which big units are customarily placed abroad, whether gas or electric, only four or five times the height of the post being taken as the distance between lamps, the double projected illumination of adjacent lamps becomes substantially identical with the normal illumination of each, so that it ceases to be a vital question abroad whether one or the other method is used, the two being nearly coincident. The thing which I wish to point out is, that if the illumination on the normal is the criterion, for heaven's sake give enough of it to see something by, and not the apologetic two-hundredths or three-hundredths of a foot-candle which has been too often talked about.

This brings up the question of economy in street lighting, and in particular I want to devote a brief moment of animadversion to the so-called moonlight schedule. I think this curious minimum of a couple of hundredths of a foot-candle which has been followed too long came largely from the fact that that value was supposed to be about the maximum intensity of moonlight in this latitude. One can read by a full moon, which gives one-hundredths to two-hundredths of a foot-candle. However, moonlight is diffused, diffused with a vengeance, and from my observation I should say that moonlight, on account of its diffusion, is at least two or three times as good as an equal fraction of a foot-candle delivered from an arc lamp, or Welsbach, or large incandescent lamp, or what not, merely because in the moon light there is complete diffusion and low intrinsic brilliancy, which allows the eye to do its best work. One does not experience trouble in driving an automobile in moonlight if he has a good head-lamp; he might have trouble in driving an automobile even with a good head-lamp in a lighted street, because the lamps in the street flash straight in his face. The practical value of diffusion is recognized at once when it is called to our attention, and it should be recognized in street lighting.

The moonlight schedule, which is the favorite method of economizing, is most deceptive. In the first place, ordinary moonlight in this latitude is less than two-hundredths of a foot-candle. In the next place, the half-moon intensity, instead of being half as good as a full moon, is only about one-tenth as good. That means that there is a large element of specular reflection in moonlight, the same as from a piece of polished cardboard. Consequently the three or four days sinks to an insignificant figure; there is only one week in the month when the moonlight is of a magnitude to be of any particular account.

Customarily the moonlight schedule is perhaps two-thirds of the full all night and every night schedule, while if proper illumination is to be obtained, it should be three-fourths, or eight-tenths, or something of that order.

A second common effort at economy is through the means of half-night lighting. Half-night lighting from the standpoint of the needs of the public is a great deal better than the moonlight schedule, because, so far as the brilliantly lighted streets of the city are concerned, the legitimate activities of the city cease before morning, so that there is some reason in reducing the number of lamps after midnight or one o'clock. If anybody has to economize rigidly, it is far better to disconnect every other lamp, or something of that kind, than it is to run them on a regularly reduced moonlight schedule.

It is never desirable to go into half-night lighting or petty economies of that kind anyhow, and my purpose here is to point out particularly that the moon is a bad thing to depend upon. If the illumination must be decreased at certain times from motives of economy, it is better to do so at convenient times and systematically than to depend on moonlight and weather conditions.

As to important things of the future in street lighting. The first of them is a recognition of the fact that streets are lighted for people to use; that the streets should be lighted with reference to the use which is going to be made of them, and on the whole they should be much more brilliantly lighted than is customary in this country to-day.

ALLEY SYSTEMS FOR LARGE CITIES.*

By Wm. A. Howell, Engineer of Streets and Highways, Newark, N. J.

IN Newark, as is the case in Jersey City, Paterson, Newton and other large cities in New Jersey, there is no comprehensive system of alleys or roadways, located between main thoroughfares, to be used for the removal of ashes and garbage and the delivery of groceries and other household supplies to the family dwelling from the rear. Philadelphia, Baltimore and Chicago have such systems and have had them since those cities were originally laid out, and they have many conveniences. In the city of Newark we have alley-ways scattered all over the town, some of them of quite ancient origin, a few indeed dating back to the foundation of the city in 1666. Most of these alleys are lined with stables, automobile garages, occasionally a small factory, but many especially in the residential districts have small dwellings located thereon. A few of these alleys in the central part of the city have been paved with modern pavements, quite a number have been paved with cobble, but the greater number until the present year have remained unpaved—have been overgrown with weeds, and have been the dumping grounds for rubbish and even garbage. These alleys have given our board of health much solicitude as very possible sources of contagion.

Every few years when cholera, yellow fever or smallpox epidemics are feared throughout the country boards of health in large cities look for the first appearance of the scourge in the alleys and in the crowded tenement houses, and give immediate attention to their thorough cleansing. And yet here far removed from the bustling outside world are the humble homes or workshops of good citizens, interested in the welfare of the community at large, taxpayers as eager for public improvements as their neighbors living on more pretentious streets. During 1909 ordinances were passed by our Newark board of public works for the paving or repairing of 14 alleys, representing a mileage of 1.184 miles, at a total estimated cost of $45,703.91, which amount included the cost of inspection and advertising. Of the mileage paved, 0.728 of a mile was paved with vitrified brick on concrete and 0.456 of a mile was paved with granite on concrete. The average cost per front foot of pavement to the property owners, of alleys paved with brick, was $3.22 and on alleys paved with granite $4.35. The average width of alleys from building line to building line was 22 feet, and the average width of the roadway was 14.68 feet. We have made many goodly improvements in our city during the last 15 years, but I cannot recall any single year, where with the expenditure of such a comparatively small sum of money, we have produced more lasting results, than our work of 1909, in transforming these 14 alleys into well-paved, well-sewered and well-lighted highways. The credit of undertaking and prosecuting this alley-paving crusade of 1909 is due to the intelligent foresight of the chairman of the street committee of our board of public works, the Hon. Arthur R. Denman, and his colleagues on our board, Messrs. Eggers, Lambert, Halpin and Budd. The work was not undertaken without opposition. A number of our worthy citizens, large taxpayers, could not see the value of the work. They were entirely willing to see the city pave alleys, if the city at large footed the bills, but in their judgment to call upon the individual property to be responsible for an assessment for alley paving or repaving was entirely unjust, coming close to confiscation of property rights. It is the opinion of one of the best-informed and well-posted lawyers in Newark, a man especially well informed regarding real estate valuations in the city, that the simple act of paving an alley, immediately doubles the value of the abutting property fronting thereon. In

*A paper before the American Society of Municipal Improvements.

other words, if land fronting on the alley before paving was worth $30 per front foot, it would be worth $60 per front foot on the completion of the pavement, although the actual cost per front foot of the paving would not be more than $4.50 per foot, and might be much less than that figure. We have in Newark about ten miles of alleys paved and unpaved. The paved alleys comprise a mileage of 3.26 miles, the following materials being used:

Cobble	1.00 mile
Brick	0.85 mile
Granite	0.75 mile
Trap	0.25 mile
Asphalt	0.06 mile
Granolithic	0.10 mile
Macadam	0.25 mile
Total	3.26 miles

During 1908 the inspectors of the board of health made 1,098 visits of inspection to the alleys of the city and reported 145 violations of the health ordinances. That alleys should be paved and well paved, does not admit of any argument. That they should be paved in advance of wider and more generally used thoroughfares is the prevailing opinion of municipal officials in nearly all large cities.

In our judgment where the traffic and the alley grade will permit its use vitrified brick on concrete is the most desirable material for alley paving. That has been the result of our experience in Newark. Whenever it is possible to do so, the pavement should be laid the full width of the alley, from building line to building line, having the gutter in the middle. If it is deemed proper on account of the width of the alley to have sidewalks, of say three or four feet in width, leaving a roadway of not less than 14 feet, a miniature street with its shallow gutters and miniature crown, rather adds to the neatness and finish of the engineering effect of the work. This brings up the question, "What constitutes an alley?" Where is the dividing line between street and alley? In our city any highway under 25 feet in width, we place in the alley classification. Through the medium of the Clearing House of the Society, our secretary, at my request, sent a circular letter to the city engineers of 35 American cities, soliciting information on the subject of this paper. Replies were received from the following 18 cities: Albany, N. Y.; Boston, Mass.; Grand Rapids, Mich.; Minneapolis, Minn.; Providence, R. I.; Syracuse, N. Y.; Austin, Texas; Buffalo, N. Y.; Moline, Ill.; New Orleans, La.; Salt Lake City, Utah; Washington, D. C.; Baltimore, Md.; Cleveland, Ohio; Chicago, Ill.; Milwaukee, Wis.; New York City; San Francisco, Cal.

The preponderating opinion of the city engineers enumerated was that the advantages of alleys greatly outweighed their disadvantages. Several city engineers, notably the engineer of Cleveland, were strongly opposed to the location of alleys in residential districts, but were in favor of their location in business districts of cities.

Reports from these 18 cities showed that pretty nearly every known kind of modern pavement was used in the various places mentioned for alley paving. The favorite materials were granite, brick, asphalt and creosoted wood block.

Our local fire board is very much in favor of alleys in the Newark business district. The chief of the fire department informed me that the city was saved on three notable occasions during the past two years from large fires in the business district by the fortunate location of alleys in the rear of large buildings which had taken fire, giving the local firemen additional opportunities of fighting the flames, which would not have been the case if the space occupied by the allays had been filled with buildings. The department store of Goerkle & Co. and two large theaters in the center of the city were saved by having alleys in the rear or at the side.

Alleys located in the business districts of large cities are admirably adapted for stables and central storage depots for large department stores, for electric lighting power plants, etc. Here away from the crowded streets, goods can be loaded and unloaded, carefully, systematically and speedily, without interruption from passing traffic on the sidewalks or in the roadway. Thousands of dollars can be saved in the course of a year to a business house with storage ware rooms located on an alley. The original cost of the site of the building on the alley is also an important item to the concern. Real estate on the broad avenue, possibly only 75 or 100 feet distant, at the front of the building will doubtless be worth from three to eight times per front foot of the valuation on the narrow alley in the rear.

In locating government buildings, such as post offices and custom houses, provision is generally made in large cities by the government architects for alleys in the rear of such structures, for the reception of the incoming and the delivery of

the outgoing mails. The public would be seriously inconvenienced if this should be attempted from the fronts of government buildings. In fact, rear alleys or side alleys are practically indispensable to the successful operation of an up-to-date post office in a large American city.

The favorite practice in a number of large cities, such as Brooklyn and Newark, is to have the period of time, when receptacles containing ashes and garbage shall be allowed to remain along the curb, reduced to a minimum. At stated intervals men in the employ of a contractor collect these cans and receptacles from yards and areas, and place them on the curb, where their contents are speedily unloaded in wagons provided for the purpose. The driver of the wagon, or his assistant, then returns the empty cans and other vessels to the place whence they were taken. This system works very well in Newark and gives general satisfaction, although it took months to get it in perfect working order. Where the above mentioned system is in use, there is little or no necessity in residential districts for alleys in the rear of dwellings. But it must be remembered that there are many cities in the United States, some indeed of more than 100,000 population, where there is no municipal provision made either by contract, or by other means for the removal of garbage and ashes, each individual householder being responsible for the removal from his own premises of all refuse. It would appear in cities of this class that alleys would be of considerable value.

THE ST. LOUIS WATER WORKS RAILWAY.

By Charles Claude Casey, St. Louis, Mo.

AN interesting experiment is being tried by the water department at St. Louis in the railway line. The department is operating a railway in connection with the water department pumping stations, which happen to be located some distance apart. It is an unpretentious railroad, doing both freight and passenger business, and is probably the only railroad in the country not subject to Interstate Commerce Commission regulation and anti-pass laws. In fact it is operated exclusively on the pass system, no fares being collected, and Water Commissioner Ben C. Adkins has the distinction of being the only railroad head in the country permitted to openly furnish national, city and state legislators and other public officials with railroad passes.

All materials, supplies, machinery and other freight used by the water department, or by contractors in repair or construction work at the plants, is carried over the lines of the St. Louis Water Works Railway. The line was opened for passenger traffic by the city in 1902, though the tracks had previously been used as a railroad switch to the water works plants by the several railroads connecting with that part of the city. High charges for the transportation of water works laborers and employes, and unsatisfactory service under contract system, moved the officials to try the municipal railway project. The service, at least, has been satisfactory and there is no indication that the line will be abandoned.

The passenger line is operated by electricity and extends from Bissell's Point, about four miles south of the terminus of the regular transit lines, to Chain of Rocks, where the intake pumping stations are located. The distance is about seven miles, connecting with Baden about equidistant between the two points. Two electric cars of modern type are used on the line, capable of maintaining a regular half-hour schedule, though no effort is made to run so frequent a service.

Last year more than 112,000 tons of freight was switched on the steam division of the road, at a cost of a little less than two cents per ton mile. Passengers numbered more than 257,000, with an average cost of a little less than four cents. Both passenger and freight business decreased materially during the past two years, due, partly, to the improvement of Columbia Bottom Road and the making of automobile and vehicle traffic along the beautiful drive more pleasant than the car ride. It is also possible that less interest was shown by sight seers in the water works park. Less freight was carried because of a reduction in the amount of contract work under way and a consequent decrease in the shipment of material.

The cost of carrying passengers is

probably high at four cents, but the cost would have been very much less had not special cars been used by officials for quick trips to and from the plants, special cars being run when an official desired to go between the regular trips. It is probable that switching charges are also much higher than they should be, were not the locomotive frequently used when it may have been profitable to wait for a greater load.

The railroad is on the map as an "Industrial Line," being rated by the Central Car Service Association. Cars are delivered to the line by the Wabash, Burlington and St. Louis Terminal Railroads from connecting switches, under the rules of the Car Service Association. Demurrage costs on cars switched to the line aggregate about $300 a year, while joint car inspection costs the department about $300 a year additional. Under the rules of the Car Service Association, the city also assumes the cost of repair to cars damaged while on the line, but this amounted last year to only about $50, or about one and one-half cents per car.

Only one locomotive is employed. It is of the saddle tank type, built in 1904 by the Baldwin Locomotive Works, after a test of two years had shown an increased efficiency of the passenger service that appeared to warrant the assumption of freight service also. The freight department also has two flat cars, used for the transfer of greenhouse materials, and other freight within the water works reservation. The cars, however, do not leave the line.

Only the two cars are used on the electric line, the entire rolling stock of the railroad being a locomotive, two flat cars and two street cars. One car is a 48-passenger modern car, purchased when the line was started, January 8, 1902, and the other is a 36-passenger car, purchased in May, 1904. The cars are often loaded beyond the seating capacity. They are equipped with electric heaters, air brakes, whistle, etc., and propelled by two fifty-horsepower motors each. One cost $5,000 and the other $4,475, but some additions have been made, raising the book investment for the two cars to $10,204.

In the first complete fiscal year after the electric line was started, 194,987 passengers, mostly employes, were carried, and the many nearly empty special cars, carrying only one or two officials, raised the average cost per passenger to nearly 5½ cents. Each succeeding year has shown an increase in passengers, except last year, and the cost has never been as high as the first year. The fiscal year ending in April, 1907, showed 301,879 passengers, with an average cost, not including interest or depreciation, of 3.3 cents. This was increased last year to 3.9 cents, but if the passenger business had been as great as for the preceding year, ending in April, 1908, the cost would have been less than two cents, for no additional cars would have been run and little would have been added to the expense with the 341,000 passengers carried in that year.

The following is a tabulation showing the number of passengers carried last year, with the trips made, by months:

Month	Persons on Trip Passes	Annual Passes	Laborers	Total	Trips	Average passengers per trip
April	6,772	447	12,681	19,900	560	35.7
May	7,027	422	13,628	21,077	518	50.3
June	9,140	424	13,931	23,495	600	39.2
July	11,045	438	13,244	25,727	560	44.1
August	16,161	377	13,700	30,238	844	35.8
September	12,924	405	14,673	28,002	610	45.9
October	8,685	406	14,270	23,361	594	39.3
November	6,115	379	12,144	18,628	500	37.3
December	6,500	280	11,040	17,820	570	31.2
January	5,568	308	9,398	14,980	492	30.5
February	5,359	223	10,512	16,388	466	35.1
March	6,856	337	11,307	18,500	524	35.3
Totals	102,152	4,446	150,528	257,126	6,838	37.6

It is rather remarkable, the average loads that are maintained! Almost the full seating capacity of the largest car, and an average of more than the normal capacity of the smaller car, was maintained for a whole year. This indicates that the average in one direction, in certain parts of the day, when the line was being used only one

way, was more than double the normal seating capacity of the cars. The trips given are one-way trips. There were only 3,429 round trips, with an average business for the round trip of 75.2 passengers. The figures are more remarkable when it is remembered that very often special cars are run with only one or two officials, returning empty for the regular trip.

From the table it will be seen that the number of trips does not depend entirely upon the number of passengers carried. Usually about nine round trips are made daily, but in summer months, when many people spend their Sundays at the Water Works Park at the northern terminus of the line, a little better mid-day and afternoon schedule is run. It will be noted that the largest numbers of passengers were carried in July, August and September, and that practically all of the variation is in trip passengers. There is more regularity in the number of employes carried, and also in the number of annual pass patrons. Any citizen may obtain a pass for the trip from Baden to the Chain by applying at the water commissioner's city hall office, or at the Baden office. These passes are good only from Baden to the Chain and return. Annual passes are issued to all persons likely to need them and considered capable of using the privilege fairly. Annual passes are good for the full length of the line and will be accepted on any car, whereas trip passes are good only at certain hours when regular employes are not being carried.

Residents of the country north of the regular transit service and in the vicinity of the water works plants, are permitted to use the line regularly to Baden, and several hundred school children, attending school in the city, also use the line without cost.

An ordinance was introduced in the municipal assembly some months after the electric line was opened, authorizing the water commissioner to collect fares to pay the expenses of operation. This ordinance failed to pass because of an opinion rendered by the city law department to the effect that if the city collected fares, the road would come under the anti-pass laws and interstate commerce regulations, and the city would be also liable for damages in case anyone using the line should be killed or injured. By the use of passes, the city specially exempts itself from liability. The road might also be required, the city counselor maintained, in the event the city should make it a commercial line, to maintain a regular schedule, and comply with many regulations that would prevent the line from being profitable, or convenient for the department.

Following is a statement of the book investment of the electric road, furnished by Arthur I. Jacobs, engineer in charge of the supply and purifying division, within which the road is operated:

Passenger rolling stock....	$ 10,204.02
Power House, building and equipment	44,355.00
Transmission and trolley circuit	48,450.00
Electric roadbed to top of rails	149,767.74
Total investment	$252,806.76

The book investment of the steam railway division is small, and consists only of about seven miles of switches and sidetracks, a locomotive and two flat cars, with a few small buildings for storage of cars, engine, etc. As a connecting link between the plants, the freight division uses the same main line as the electric road, but it is charged only with the switches. Track maintenance charges, however, are borne jointly by the two systems, excepting switch and sidetracks, which are maintained as a charge against the freight division only. The freight division is charged with $150,000 book investment, raising the total value of the road, exclusive of right of way, to about $400,000. Interest and depreciation is not figured in the operating and maintenance expenses as given below, and would about double the expenses were such a charge made.

From the following table it will be seen that the greatest item of expense is that of salaries. As is usually the case in municipal work, more men are probably maintained than are actually needed. There is an extra crew for the locomotive, and one extra crew for the passenger division. That is, three motormen and three conductors are maintained for two cars, which only run during hours that one crew would handle. Four men—locomotive engineer, fireman, switchman and switch foreman, corresponding to conductor—are employed by the freight division. An exactly similar crew, receiving the same wages, is employed at night. Besides the regular crew on the electric cars, the road employs an electrician at $125 a month and two linemen at $85, besides a lineman helper at $2.40 a day. Motormen and conductors get $60 a month. The locomotive engineer gets $3.80 a day; fire-

man, $2.20; switch foreman, $3.06, and switchman, $2.80. Two track foremen at $75 are also employed, and the wages of a goodly number of laborers are included in the items labeled repairs and track maintenance.

The following table shows the operating cost of the freight and passenger division, not including interest or depreciation:

Items of Expense	Freight Dept.	Passenger Dept.	Total
Crew, salaries	$ 3,918.38	$4,702.60	$ 8,620.98
Repairs, rolling stock	134.96	1,036.79	1,171.75
Locomotive maintenance	237.26	.....	237.26
Coal	618.40	.....	618.40
Oil, waste, etc.	47.03	11.76	58.79
Track maintenance	6,063.28	2,145.44	8,208.72
Car inspection	424.88	.....	424.88
Car repair	16.49	.....	16.49
Locomotive shed repairs	7.05	.....	7.05
Repairs to cinder car	53.51	.....	53.51
Demurrage	40.00	.....	40.00
Repairs to scales	71.37	.....	71.37
Miscellaneous supplies	4.87	40.28	45.15
Power, electric	.....	1,943.86	1,943.86
Repairs to line	.....	1,229.31	1,229.31
Line at brick yard	.....	12.19	12.19
Repairs at railway station	.....	69.13	69.13
Totals	$11,637.48	$9,962.05	$21,599.53

Because of less construction work at the water works plants, the amount of switching for last year, as shown by the table, is less than for either of the three preceding years. For the year ending in April, 1908, for instance, 167,529 tons, or 3,884 car loads, was switched at a cost of $5.08 per car. The ton mileage was 927,229 and the cost per ton mile averaged 2.12 cents.

Freight carried last year aggregated 112,031 tons, in 2,742 cars and 588,758 ton miles. The average cost of switching per ton mile was 1.977 cents, and the average per car was $4.24. The cost of switching coal, of which the following table shows 48,240 tons, averaged 8.2 cents per ton. The following table shows the business done by the freight department:

Kind of Freight	Cars	Tonnage	Tons Freight
Coal	879	48,240	199,428
Lime	440	12,072	96,084
Iron	181	5,171	36,182
Rock	664	28,183	163,801
Sand	128	6,228	33,896
Cinders	127	3,138	10,701
ravel	96	3,998	24,644
Brick	63	1,994	8,350
Lumber	21	359	1,371
Steel	20	380	2,910
Cement	19	749	4,400
Ties	15	410	2,110
Pipe	14	237	1,006
Machinery	13	177	1,273
Scrap iron	10	126	63
Miscellaneous	52	571	2,759
Total freight	2,742	112,031	588,758

The operating cost of the road for last year was reduced so greatly that the decrease in freight handled did not show a higher average cost, but, on the contrary, showed a decrease per ton mile of .143 cents.

The financial end of the proposition is not as encouraging as that of convenience, for there is not a dollar of receipts to balance against the $21,600 of expenses. Convenience and a possible saving in the aggregate cost of running the water department, however, were the only considerations in the starting of the railroad, and considered from that point of view the road may be successful financially. There are no figures, though, to substantiate any claim of less operation costs of the department as a whole, because of the railway.

In justice to the line and its management, however, it seems only fair to explain the condition of the transportation problem now, as compared with the former arrangement. When the electric line was started in January, 1902, the department had a contract with the Burlington railroad to transport employes from Baden to the Chain of Rocks works for $5,000 a year. Baden, as has been explained

before, is four miles north of the southern terminus of the electric line, and but three miles from the Chain. Before the city line was started employes were only carried from the end of the private transit lines, or from Baden to the Chain, but employes are now carried, when convenient to them, from the Bissell's point station, four miles further. Under the contract only employes were carried, and in addition to carrying a larger number of employes, nearly as many citizens are now carried free of cost. Another convenience to be considered is the number of trips made, which, under contract, was but four a day. This has now been increased to nine and ten a day, round trips from Bissell's point to the Chain, not including special cars frequently run from the Bissell's point or Baden offices to the Chain and return to carry parties or one or two officials. The cost is about 40 per cent. greater, but seems to be worth it.

It was stated that there were no receipts to balance the operating cost, but the statement was made without consideration of the electric light and power service that is being furnished. The power plant and transmission line are included in the electric railway book investment given, and the cost of operating the electric railway includes, to some extent, the cost of furnishing the electric current used for the remainder of the system. It is not necessary to assume, however, that because the light and power plant for the whole water works system is figured as an investment on the railway books, that the railway is necessary to the successful operation of the light plant. This is not the case, and the department could easily have made its current without establishing a railway. If the railway were credited with the saving resulting from the starting of the light and power plant, the receipts represented by the difference in the present cost as compared with the former contract cost would have paid for the railway maintenance and operation. If the city were now paying the contract price it was paying before the several municipal plants were installed, the cost of current for the water department would be approximately four times what it now is. With the installation of two or three municipal plants in public buildings, which now furnish light and power current to nearly all of the important city buildings, the contract price dropped. At the reduced price, the water department was paying $11,000 a year for half as much current as it now uses, and the double quantity of current is now costing only about $8,000, or something near 28 per cent. less. Not only is the department getting its current at less than two cents per kilowatt hour, but the establishment of the power plant, and that of the five other municipal plants, has fought down the price of current which the city still has to buy to 4½ cents, against 13 cents formerly paid. Small consumers are still paying 12 cents, which is an indication of what the city would be getting were it not able to defend itself. These are really considerations aside from the railway. The instance is cited to show the condition which led up to the railway, and not as an effort to show the railway itself to be a financial success.

It is hard to estimate the financial status of the freight line. It is operated as an entirely separate proposition, operating and maintenance expenses being kept separate. There are no figures to show the change in cost. Most of the switching was done as a part of the original freight charge, and it will be seen that it would hardly be possible now to separate the former cost and compare it with the present. It is also mostly a matter of convenience, otherwise the line likely would be abandoned. The locomotive is always ready, day or night, to furnish transportation power for moving machinery, setting cars, or any switching work that may be required, thus avoiding the necessity of calling for expensive service from the Terminal railroad. The line is really outside the city and beyond the regular city terminal service, though the city limits are extended north three miles along the river to take in the line and water works plant. Officials also estimate that contractors taking work at the water works plants, knowing that they have the switching facilities of the city line at their disposal without cost, bid much less for construction and reconstruction work, thus giving an invisible saving that may tend to make the line profitable, for there is much work to do, and contracts result in much switching, in a $30,000,000 water works system.

BITUMINOUS PAVING CEMENTS.*

By L. Kirschbraun, Asphalt Chemist of Chicago, Ill.

RECENT years have seen a great advance in the technology of the asphalt paving industry. Competition and the monopoly previously held by the Trinidad asphalt have forced the development of other sources of supply. The first successful paving bitumen so developed gave impetus to scientific developments in this industry and opened a field of endeavor to engineers and chemists which, in spite of the tremendous advances of the last ten years, must still be in the early stages of evolution.

The necessity for knowledge and the pressure for ever-increasing competition brought workers into the field from two directions. From one side chemists and laboratory experts who patiently devised tests and separations to fit personal theories founded upon their own laboratory results. On the other side were the practical workers in the field, the much maligned rule-of-thumb men, who manipulated their materials as best they knew—who often produced surprisingly good results, and as often poor ones. This occurred because they failed to grasp the principles underlying their manipulations and because of the lack of practical methods of controlling the conditions entering into their work. It was only when the chemist included the paving plant with his laboratory and learned to develop the means of control which were of practical value that the co-operation necessary for such development could be effected.

The advance has since been rapid, both in the direction of a more extended laboratory knowledge of the properties of bitumens and also from the viewpoint of practical results. Various principles underlying the manipulation and preparation of paving mixtures are being developed and recognized from the close laboratory and field observation of resulting successes and failures in practice. Laboratory methods and tests based upon such observations and not upon theories have pointed out the wide practical application of these principles and have opened up a fertile field in the combining of various solid bitumens, in the selection of the proper fluxing materials, and finally in the proportioning of the various elements entering into the paving mixture. All of this has made possible the utilization of bitumens formerly not considered capable of producing good pavements. In fact, the testing of bitumens bids fair to become not so much a matter of differentiating the good from the bad, but more properly a means of determining just what method of manipulation and handling is required for the successful use of the materials examined. In a practical way, it is quite possible now to determine from properly prepared data of chemical and more especially of physical properties, the lines along which an untried paving cement should be manipulated to produce such successful results.

The proper manipulation of a paving bitumen is becoming recognized more and more as the determining factor in its success. No chemist is justified in giving an opinion of an asphalt without consideration of the method of its handling. Few asphalts can be successfully treated each in the same manner as all the others, and the tendency of most operators towards manipulating untried asphalts in the same way as they would handle Trinidad or Bermudez has resulted in many failures which have been unjustly attributed to some inferiority of the asphalt itself. Consider, for example, the use of Gilsonite, which today, when handled properly, gives excellent results. The first users of this bitumen combined it with a paraffine flux. Its use in this way and along the lines of Trinidad was, to say the least, unsatisfactory. Later, with the development of the asphaltic base oils, its use was resumed, but not with complete success until it was discovered that the paving cement with such flux must be prepared of much different consistency, and that more of it was required than in preparing a mixture in which Trinidad asphalt was used as the cementing material. The Gilsonite was at no time at fault; its success was entirely a matter of manipulation. Consider further the situation had Gilsonite been the first successful material in use. The later use of Trinidad or Bemudez asphalts, handled along the same lines as Gilsonite, would have done much toward discrediting the early recognition of the value of these materials. The development of the standard paving mixture, both as to sand grading

*A paper before the American Society of Municipal Improvements.

and as to the proportion of bitumen, gave expression to an immensely important principle, yet its application is particularly effective to those bitumens in use at the time of its development, and in general to bitumens of similar properties. Its application as a hard and fast formula to all paving bitumens, irrespective of their nature, would result in error, and as a matter of fact the strict procedure along these lines has produced many imperfect results with certain asphalts which differ widely from Trinidad in those physical properties which do not favor this form of mixture.

The testing of bitumens has properly followed along the lines of comparison with successful materials taken as a standard. However, exaggerated value and improper interpretation have been placed upon many of these tests. For example, ductility tests, although having their proper significance and value, mean little or nothing when considered in terms of ductility itself. A California asphalt having several times the ductility of Trinidad is not thereby a superior material. Testing along these lines has often led to eroneous conclusions, as variations from results obtained upon the standard material have not been properly interpreted, but more often considered as indicative of inferiority. Results in actual practice have often seemed to confirm these conclusions, when, as a matter of fact, these results might more justly have been ascribed to the manipulation of the material in question along the lines of the standard rather than in the way to which such material was individually adapted. The necessity for a wider interpretation and extension of laboratory data, with a view to adapting the manipulation to meet these variations in physical properties, is evident.

It has been the experience of the writer to note in several instances that certain asphalts or combinations of bitumens, condemned as unfit for paving by chemists basing their conclusions upon comparative data, have, in actual practice, given successful results. This has been accomplished often accidentally, sometimes through the intelligent manipulation of the material in accord with its particular needs. Study of such results, together with the development of laboratory methods capable of discerning the significance of certain physical properties, has made it possible to recognize the underlying principles governing the manipulation of previously unsuccessful asphalts and combinations of bitumens. The application of these principles is so broad as to point out the possibility, that given certain basic conditions as to cementing value and chemical stability, almost any asphalt can be so modified or manipulated as to produce a satisfactory pavement.

The writer does not wish to advocate the unrestricted use of all of the various paving materials now upon the market. Nor should the unlicensed experimenting which would result from such a condition be encouraged. Few contractors are capable of working out the proper manipulation of an untried bitumen possessing different properties from the ones to which they are accustomed. Under such conditions, specifications entirely open in character would invite disaster to a municipality. On the other hand, where intelligent inspection, both laboratory and plant, is maintained by a city, a widening of the range of admissible materials becomes advisable to the extent that the inspection system fulfills its purpose, and in the degree that the contractors become educated to scientific methods and to the principles involved in these manipulations.

MEMPHIS UNDER A CITY COMMISSION.

THE city of Memphis, Tennessee, was perhaps the first city in this country to have a form of government approximating the modern "Commission Form." It was imposed upon the city as a matter of necessity and without reference to the principles upon which it should have been based, and consequently has been more or less unsuccessful up to the present date.

The last legislature modified the form to conform more nearly with that now known by the name, and the new administration takes its place on the first of January, 1910.

During its early history, beginning December 9, 1826, the city passed through the stages of town and city government, election of mayor from the board of aldermen and by popular vote, martial law in 1864-5, one and later two legislative bodies, until the yellow fever epidemics of 1873 and 1878 depleted the population and, by

the consequent increase in indebtedness and diminution in taxable values reduced the city to bankruptcy.

As a method of gaining time and authority to settle with its creditors, the city surrendered its charter and the state legislature formed the taxing district of Shelby county and established as the governing agencies a board of fire and police commissioners and a board of public works, which, together with a board of health formed the legislative council. There was also a school organization, a water commission and later a park commission was established, all of which were independent of the other activities of the city. Taxes were imposed by the legislature directly, and the old city debt and new bonds of the taxing district were governed by the legislature. Later amendments were made which restored the name of the city and the power to levy taxes, but the issue of bonds could only be made by direct authority of a legislative act, and for the last four years the city's administrative bodies have been a board of fire and police commissioners of five and a board of public works of ten, which were of equal law making power, and together formed the legislative council.

This organization now gives way to a commission of five, including the mayor, the members of which, when the terms of office of the holdovers have been equalized, will be elected every four years.

While the double commission emphasized the irresponsibility of individuals, the history of the city under it gives some exaggerated idea of what may be possible, with the best of intentions, under a commission form of government when the fitness of the individuals for the offices they will fill on the commission is so thoroughly a matter of chance as it is in most of the variations of the plan which are now in operation or are just coming into action.

The city of Memphis is growing very rapidly, particularly in business and in importance in the district of which it is the natural center, and is becoming exceedingly restive under the restrictions of law and of inadequacy of methods of handling its business and making its improvements. This is shown in various ways: By the free hand given the park commission under special laws, by the efforts to broaden the power of the city government in inaugurating public improvements, by the efforts of the public spirited organizations of business men to find out what is the trouble with the municipal government and what can be done to set it right.

The former movements will be considered in later articles. The last resulted in the establishment at least temporarily of the Bureau of Municipal Research, which is based on the same principles as the corresponding organization in New York city, which supplied a trained expert to carry on the detail of the Memphis work.

This bureau has recently published its first report, which discusses the defects in the plan of government of the city and illustrates them by descriptions of methods of doing business in one of the departments under the board of public works. The report again demonstrates the fact that elected officials of a city are seldom experts in the duties pertaining to their departments, and that when the demands of politics are met by these officers the quality of subordinates selected is not always of the highest, the restrictions upon those who are competent are too severe to permit the best service, and the unwillingness of the incumbents of the various offices to aid other officers or permit interference with or addition to their own duties all cause the methods of doing business to fall into certain ruts, which may or may not follow the law, but are in the lines of least resistance.

An example from the report will show what happens without any particular influence to give direction to the course of procedure. It is not hard to imagine what might occur if some one gave a conscious direction which would give him an opportunity to take dishonest advantage of the lack of system.

Requisitions are made without check as to whether they may overdraw the appropriation upon which they are drawn. Orders are often given verbally and invoices may reach the department long after the materials have been used beyond hope of checking the voucher, there being no regular record of receipt of goods. When the invoice, written or verbal, is approved verbally or in writing, a voucher is prepared, approved by the head of the department after verification of extensions and additions, accepted by city paymaster, signed by city register, who prepares warrant which is signed by mayor and two fire and police commissioners and the city tax receiver, delivered to the payee and receipted for by him and once a year all vouchers are audited by expert accountants appointed by the legislative council.

That this procedure is ineffective is

shown by numerous instances in the report. Thus in one voucher for $3,383.54, an item of $25.80 was entered as $258.06; another of $4.72 was entered as $47.25; and another of $7.42 was entered as $74.25, making a total difference in favor of the payee of $341.62. These errors were in the original invoice, and notwithstanding the numerous signatures attesting the correctness of the voucher were not detected until the investigation by the Bureau of Municipal Research discovered them.

Accounts were overdrawn, vouchers were assigned to wrong appropriations and other errors occurred, showing utter lack of co-operation of officers and of efficient check upon their operations.

from the dropping of ten men and a rearrangement and reassignment of duties to the five remaining. The commission is still both the legislative and the administrative body.

The mayor, in addition to the general supervision of all the affairs of the municipality, assumes direct charge of the offices of city attorney, city judge, city clerk, health department, city paymaster; certainly enough for one man.

The fire and police departments are under one commissioner instead of five.

The department of streets, bridges and sewers is under one commissioner instead of a board of ten.

The new department of accounts, finance and revenue will take up the accounting for all departments and include the inspector of weights and

MEMPHIS LEVEE IN THE COTTON SEASON.

The same lack of business methods is shown everywhere, being even more pronounced farther up. Thus the budget is fixed with no reference to the actual needs or the relative needs of departments and appropriations are made with the expectation that the law will be violated by overdrawing them. The fact that the same authority which spends the money also makes the appropriations makes it easy to transfer funds and manipulate them to keep within the letter of the law.

Numerous similar difficulties are shown in the report. There will be no change in the theory of the government of the city. The changes are only in form, and four of the present legislative council (possibly five) will be on the new commission of five, so that there is no change in personnel aside

measures and the collector of license and privilege taxes. This department is the one which can do the most in bringing the business of the city into systematic operation. If it will begin at the beginning with expert operators and will bring order out of the existing muddle (which will become for a short time a chaos under the new administration), and will do this without granting favors to any one or to any department, it will do much to prove the value of the commission form and will give the city government a standing which will carry it through many errors in other directions.

The department of public utilities, grounds and buildings will have charge of railroads, street car lines, lighting, telephone and telegraph companies, the water department, wharfmaster, mar-

ket house, and inspectors of buildings, gas, electric light, boiler and electric installations, public grounds, buildings and parks, provided that it shall not interfere with the park and water commissions. This class of problems will also be much the better for being in charge of a special commissioner.

One valuable feature of the new law is the establishment of a civil service commission appointed by the city commissioners which tests the qualifications of persons for employment in the various departments.

Bonds may be issued by the city commissioners, but the voters may on petition have an opportunity to decide whether they shall be issued or not.

The school, park and library taxes are fixed by the law and must be levied by the city commissioners and paid over to those departments for their independent use. These departments are also granted by the legislature independent powers of issuing bonds within limits fixed by the legislature in each such act.

The act is brief and continues in force the existing charter provisions not conflicting with it.

The new mayor was one of the holdover commissioners, so that the first act of the new commission will be the filling of the vacancy. The one officer was voted for at the election in November, and party lines were almost wholly ignored, although there was some indication of considerable factional strife. The great interest in the new form of government was shown by the large poll, and the business man, with some experience in the council, was chosen, his principal opponent being a man more generally known as a politician who gave excellent satisfaction as mayor in former years.

Memphis is bursting the bonds of its youth and preparing for the large growth which is ahead, and its career under the new form of government will be watched with great interest. Later articles will show the excellent work done by park and water commissions under the freedom which is theirs and the difficulties which have attended the development of sewer systems and street paving under the serious legal handicaps of the past. These are now in process of removal, and further changes in the laws permitting greater freedom of action will doubtless be made if the city commission shows that it is worthy of being granted the larger powers.

MUNICIPAL OWNERSHIP IN EDMONTON.*

By A. Maclean, Superintendent of Water Works, Edmonton, Alberta.

THE following outline of a series municipal enterprises conducted in the city of Edmonton may be of interest to most of the members of the American Waterworks Association. Few of the delegates attending the convention can be much in touch with the principle of municipal ownership and management. The general absence of belief in the adoption of the principle is evidenced by the fact that only a few city councils on the North American continent have had the temerity to indulge in such experiments, and the writer, in placing before the convention this snmmary of Edmonton's doings, is actuated by the desire to make known to his fellows engaged in civic utilities, some facts seldom met with on this continent. In no way is the paper intended to convey the idea that all cities can operate their own utilities successfully. The great essential of the success of all enterprise—good management—may or may not be present in the attempt of a city to own and operate its own utilities. Where it exists, success will result; where it is absent, failure is sure; and the presence of good management should alone dictate the extent to which the principle should be adopted.

It is generally conceded by all authorities on the development of municipal ownership that the city which starts on the path of collective enterprise usually begins with water. The municipal control and operation of waterworks is the first logical step in a city's growth toward municipal ownership. The fact that water is the first utility which a city seeks to own is due to a number of obvious causes, the foremost of which is the relation of a pure and plenteous water supply with public health and fire protection. It might be unsafe to contend that all cities (or the majority of cities) on

*A paper before the American Water Works Association.

this continent own their own water supply, but it is generally the case that cities seek to own that utility before owning others. As a waterworks superintendent I have always believed that the public health and security from fire enjoyed by a community is measured by their ownership of the water supply and the intelligent interest which the community takes in that ownership and operation.

In the city of Edmonton, however, where the writer is at present situated, the council has gone far beyond the initial step of taking over the water supply. Early in its history the city fathers conceived the idea that anything of the nature of a monopoly could be best administered by the city. The sphere of activity in a city which is usually occupied by the telephone company, the street railway company, the electric light and power company or companies has in this city been occupied as a legitimate ground to expand the functions of municipal government. The conservative-minded observer, who believes that private control alone can successfully manage large undertakings, may look with grave misgiving at such a gigantic undertaking in collective enterprise, yet the experience of the city of Edmonton is that the adoption of the principle has been phenomenally successful.

The writer during that portion of his life as a municipal servant in the city of Vancouver had little belief in the success of a municipality to undertake the operation of street railways, telephones, etc. On arrival in this city, however, he was faced with a new set of conditions. Obstacles which he believed existed to make municipal ownership an experiment of some risk he has seen overcome easily. Benefits which he believed could be best realized by a municipality whose enterprises were in the hands of corporate interests he has seen were the lot of the citizens of Edmonton to a degree and in a measure never before met with in his experience in other cities. Naturally, he has been forced to revise his ideas regarding municipal ownership; he has had to reform his conclusions in the light of an array of evidence hitherto not in his possession. If it were not for the length to which a discussion of the principles underlying successful municipal management might be carried, and the inability of the writer to do such an important subject justice, it would be his endeavor to deal with the entire subject. Failing such a discussion, however, he would like to summarize some of the benefits of the adoption of the principle in Edmonton, and emphasize what appear to him to be the greatest factors of its success.

The city government here consists of a mayor and council, elected by the people; a board of three commissioners, one of whom, the chairman, is the mayor. The commissioners are appointed by the council, one being known as finance commissioner and the other as public works commissioner. In mentioning the composition of Edmonton's civic government, it is the writer's opinion that the form of government has no direct relation to the success or non-success of the principle of municipal ownership. Given a community of average intelligence, possessed of a normally live interest in its own affairs—a community holding its elected aldermen responsible for the success of its administration—it matters little whether the commissioner system or the committee system be the method of administering the business. Responsibility for the success of the city's enterprise is of far more moment; and the community which retains the services of its best aldermen and sees that their administration is always at the high-water mark of efficiency, will secure results independent of what form the government of the city takes.

In the matter of its selection of councillors, the city of Edmonton has been singularly fortunate. Men of sound business experience have willingly given their services, and the record of the past five or six years of municipal enterprise has produced results which are a credit to all concerned.

It may seem strange to many that such a statement should be made, but the writer is convinced that the councils of the city of Edmonton have carried through work, embarked on projects, financed undertakings, with a degree of success impossible to private enterprise. All this has been accomplished, too, without any monetary interest accruing to the directors, who, sitting in their capacity as aldermen, have worked more efficiently than the directorate of a trust, with the largest possible dividends in sight, would have done. In this connection, he would like to mention a few striking differences between private enterprise and municipal enterprise.

The first difference most noticeable is the ease with which a city with an assured future can borrow money in the world's markets. When the markets of the world are closed to the best class

of security held by corporate interests, the well-governed city can obtain money for its undertakings with ease. It can at all times secure more and cheaper money for its ventures than private enterprise can secure for the same kind of ventures. And this is one of the first and greatest advantages which municipal ownership and operation has over private ownership. It may be that the people of Edmonton have a different viewpoint from that of the people of other cities. The writer knows they possess a viewpoint which was not his before he lived here, but it cannot be denied that the determination which they have evinced to control their own franchises has resulted in a success creditable to their council and themselves.

Another difference between municipal and private enterprise is the fact that the citizen who uses the city's water is aware that its rates coincide exactly to the cost of production of water. If his rates are high, then he seeks to discover the cause, and the result is usually that he does discover it, and the inefficiency or lack of economy is remedied. So it is throughout the whole field of municipal management. The fares of the street railway cheapen in proportion to its success. The rates of the electric light, power and telephone are reduced as the increase in the number of users of these utilities makes economy possible. This is not a mere theoretical statement of the effects of municipal ownership; *it is the actual experience of the citizens of Edmonton.* Some may imagine from this that an ideal condition of life must exist in our Albertan capital, so the writer hastens to assure them that we are not yet a Utopia, but bear all the evidence of being one in the making.

The writer now comes to what he believes to be the greatest controlling factor in the success of municipal management in Edmonton—the fact that the heads of departments have been given complete control of their respective spheres, with a tacit understanding that they have been placed there to make good or get out. Not merely is the mechanical operation of each department completely under the control of the superintendent, but he also is responsible for all the financial details involved in its operation, both of revenue and expenditure. This entirely precludes the interference from which expert city officials sometimes suffer, and leaves each superintendent to pursue the even tenor of his way in peace. The value of such a course, viewed from the point of efficiency, cannot be overestimated. It is hardly to be wondered at that Edmonton should forge ahead on its progressive course, and that with a street railway system which would do credit to a city twice its size and fifty times its age; a telephone system of the latest Strowger automatic electric type; a power and light system growing fast, but scarcely fast enough to accommodate users on account of its exceedingly low rates; an extensive waterworks system gradually being evolved and expanded to meet the demands made upon it by its growing population; Alberta's capital should lead the way to a condition of municipal life in which all the cities of North America should control their own franchises and utilities and dispense with all the scandal and suspicion of graft which connects itself with their sale.

EDITORIAL COMMENT

Depreciation and Sinking Funds.

Care of Street Trees.

Woods for Block Pavements.

DEPRECIATION AND SINKING FUNDS.

The modern and more accurate methods of accounting which are being introduced in all sorts of corporations, and most noticeably in public service industries under both public and private ownership, require that attention be paid to some items belonging to the cost of production which have heretofore been neglected to a greater or less extent. It has been too generally the custom, in manufacturing plants particularly, to assume that the net profits of the year are the apparent net profits, and to declare dividends from them. This plan works where depreciation of plant is slow for a number of years, but the day of reckoning comes, when renewals of plant must be made and the money to make them has been distributed in dividends. The increase in expenses on account of the reduction in efficiency of plant comes at the same time. The result is stoppage of dividends, if the profits are large enough to make up the deficiencies, issuing of new capital by sale of bonds or stocks, or bankruptcy and reorganization. The losses by the latter step are therefore often more imaginary than real, the reduction of dividends or scaling down of investment in the times of trouble being merely the forced return of the prior dividends which should not have been declared, but which should have been held for the reconstruction which is inevitable. Much of the watering of stock which is done has as its excuse the large dividends which are possible so long as depreciation and repayment of borrowed money are neglected, so that large showing of profits can be made.

The lack of provision for repayment of bonds mentioned in the last sentence is quite as reprehensible as the neglect of depreciation. The two are of similar nature and have similar effects. Indeed, they may almost be considered the same.

There has been much discussion of the subjects of depreciation and sinking funds, and there is much misapprehension and misunderstanding regarding them, even among expert accountants, and the results of this misapprehension and misunderstanding are shown in the considerable differences in the terms of court decisions upon cases involving them. Experts are far from agreement upon their treatment, and the following is offered as a contribution to the discussion in the hope that it will throw a little light upon some of the dark places.

Perhaps the clearest illustration of the principles can be given by making some assumptions which in themselves are practically impossible, thus separating into parts the complications of the actual cases.

Let us assume that a plant is built with money raised from the sale of stock, and that it is operated at an annual net profit sufficient to meet all legitimate demands. These demands apparently are that the annual dividends shall be equal to the market rates for money, and that the investment shall be as safe and as profitable at any time as it is at any other. A very simple instance would be a water plant supplying a constant number of consumers with a constant supply at a constant price. The cost of operating this plant will not be constant. The amount of useful work done by it will be constant, but depreciation in the machinery will increase the cost of operation, depreciation in the distribution will increase the leakage and consequently increase the pumpage, depreciation in boilers and pumps will increase the amount of coal consumed, etc. This depreciation ultimately requires the renewal of the entire plant.

not all at once, because no two parts of the plant wear out at the same rate, but ultimately every part must be replaced.

There are two ways in which this replacement and increase in cost of operation, both due to depreciation, can be taken care of. One is to charge it to cost of operation, the other is to provide a fund out of the net profits with which to make the replacements. Some accountants contend that both these classes of charges must be charged to operating expenses, so that the plant will always be kept up to the condition when it was new. This contention is undoubtedly correct if the capital stock represents all the cash put into the plant. The only difficulty is that the charges vary from year to year with a marked tendency to increase, except perhaps for a few years after each thorough overhauling, for the year of which the charges for depreciation would be excessive. If, therefore, the assumed conditions of maintenance of value of investment are to be met, there must be some sum set aside each year which will in the long run equal the expenditures due to depreciation, but will, under the conditions of uniform income, be the same amount each year. This account must have some name, and, since the whole of it is due to depreciation, it may well be termed the depreciation account, and it may be credited each year with the amounts expended during that year to maintain the condition of the plant and meet the increase in cost of operation which cannot all be eliminated every year by the highest possible standard of maintenance.

A second assumption may be made which is the same as the first except that the entire cost of the plant is met by the sale of bonds, in which case, to prevent complication, the stock should represent only the control of the corporation and should receive no dividends. The cycle of the corporation is completed without loss or gain, aside from the service rendered and the interest on the bonds, if the bonds are all redeemed when the plant is all worn out. Theoretically, therefore, there should be money enough on hand when the bonds are due to pay them, and, if the plant were like the "one-hoss shay," it should go out of existence at the same time. That is to say, the period which the bonds are to run should be the theoretical life of the plant, and there should be set aside each year a sum which, with the interest thereon, will equal the bonded indebtedness when it is due. The operating expenses will be charged each year, therefore, with the interest on the bonded indebtedness and a uniform payment toward the sinking fund. They will increase each year by reason of the depreciation, as above explained, unless some balancing is done.

Under the first assumption the plant is kept up to the original condition all the time and the investment will still be intact at the end of any period. Under the second assumption the investment will be returned at the end of the period and the plant will be worn out.

A company operating strictly according to economic laws under a perpetual charter would follow closely the process of the first assumption. A company operating under a limited charter providing that the plant should be turned over to the city at the end of the franchise would approximate the procedure under the latter assumption, the principal difference being that the rates charged consumers would be large enough to pay the value of the plant as turned over to the city in addition to the charges necessary to be met under the said second assumption. The value of the plant at that time would be the remainder after deducting the depreciation for the franchise period from the original value of the plant, plus whatever had been spent on it to replace depreciation and keep the plant in condition for economical operation.

Under the first assumption it is necessary to fix a schedule of lengths of life of the various parts of the plant, estimate the increases in operating expense and determine a uniform amount to set aside annually for the depreciation fund from which to draw for replacements and renewals. In any actual case judgment must be exercised

at all times as to what should be charged to this fund and what should be treated as new construction and therefore paid for out of new capital.

In the second case the average life of all the parts of the plant must be assumed as the period of the bond issue; a sum should be computed for increase in operating expenses or its equivalent, replacements to prevent the increase in operating expense; and the capitalization of this sum plus the cost of the plant will be the amount of the bond issue. If the bonds all run for the whole period, the sinking fund payment each year with the obtainable rate of interest will be fixed and is the annual charge against operating expenses.

So far as the charges against operating expenses are concerned, the two cases are equivalent. In one case the charge goes to a depreciation fund, in the other case to a sinking fund.

Some accountants contend that both allowances must be made, but this separation of the two cases for purposes of demonstration apparently teaches that either one is sufficient to complete the round, and that if both charges are made we have at the end of the bond period not only a repayment of all the original cost of the plant, but also the plant in a condition equal to its original. The stockholders, therefore, who under the second assumption put no money into the concern, have come out with the entire plant in its original condition. The consumers have paid for this plant in addition to their legitimate payments for service and interest and one repayment of cost of plant. They have paid this sum over and above the proper charge. Doubtless this doubling of charge, whether consciously or unconsciously made, accounts for a large amount of the water in the capitalization of public service corporations and others as well. The provision for the double charge in the rates and then the neglect of the charge in declaring of dividends accounts for much more water, and for high dividend rates followed by receivers and reorganizations when the time for bond paying or rebuilding of plant arrives.

Payment of depreciation from year to year, even when equalized, results in higher rate than payments to a sinking fund which draws compound interest, but it results in better condition of plant and more economical operation.

In any actual case the procedure must be a combination of these two processes, because part of the money invested in the plant is derived from the sale of stock and part from the sale of bonds, but it is certain that this combination must not be the sum of the two, but such a distribution of them that the plant will be kept in good working condition and the bonds repaid at maturity, but the value of the plant added by the payment for the bonds shall not accrue to the holders of the stock unless they shall have made the additional investment, either by putting in new capital or by foregoing their dividends for the benefit of the sinking fund.

If convenient, both depreciation and sinking fund accounts may be kept, but the sum of the two should never make a charge against the annual receipts greater than the average depreciation charge under the first assumption made.

CARE OF STREET TREES.

The interest in street trees is growing rapidly. The earliest statutory provision, aside from brief provisions in a few city charters, was the New Jersey law under which East Orange has been operating for a few years with the success which has been reported from time to time in MUNICIPAL ENGINEERING. Pennsylvania followed with a similar law, which is slowly gaining recognition from the cities of the state.

One of the most recent movements in the interest of street trees is one begun by the Chicago Womans Club a year ago, which resulted in an ordinance authorizing the Special Park Commission, which has jurisdiction for certain purposes over the city generally, to appoint a city forester to take charge of the street trees and to advise property owners regarding the care of their trees.

The apportionment for the first year being limited to the salary of the forester, little beyond advisory work has been possible. The activity of the new officer is suggested by the series of bulletins and pamphlets which he is issuing. These publications will be of value to others and can probably be obtained on application to J. H. Prost, the city forester, at 501, 200 Randolph street, Chicago.

One bulletin is devoted to the tussock moth, which is illustrated and described, so that citizens can recognize and destroy the cocoons and egg masses, which is the simplest and most economical method of destroying the pest.

The first pamphlet gives a short history of the establishment of the office and the ordinance governing its activities.

The second pamphlet is an argument for planting and caring for trees, gives twelve reasons for planting them and a list of ten cities having forestry departments for which appropriations were made in 1908, and the list is not complete. The appropriations listed vary from $1,504 in Minneapolis, Minn., to $42,000 in Newark, N. J.

The third pamphlet gives some of the causes destructive of tree life, preventive remedies and suggestions and directions for the removal of dead trees and the trimming of those that are unsightly.

The fourth pamphlet tells what trees to plant and how to plant them.

This is a good beginning, and while results are slow, the forester can soon demonstrate his value and thus secure the financial backing he must have.

Too many cities, large and small, hesitate to attack the problem, thinking it is too large and scattered and that there will be too many objections from property owners and taxpayers, but no city which has once put the matter in the hands of a competent board with expert assistants has withdrawn its support entirely, although the size of appropriations varies. The failures have been made by putting the work in the hands of incompetents, for other reasons than the value of the work, or because there was total lack of tact in the executive officers or because they were not given time enough to demonstrate the value of their work.

The problem is a large one, but, fortunately, it is one which can be worked upon with large or with small resources as may be necessary. Results must be proportional to efficient effort, however, and a small appropriation can not bring the results of a large one, other things being equal.

Beautiful as the trees of many of our American cities are, they can be greatly improved under competent supervision. The cities which are lacking in this regard will do well to study the New Jersey and Pennsylvania laws, which have been explained in this magazine, and follow their methods of procedure as closely as possible.

WOODS FOR BLOCK PAVEMENTS.

In August, 1906, the city of Minneapolis, Minn., and the U. S. Forestry Service co-operated in laying a section of pavement on Nicollet avenue, using several different kinds of wood, creosoted with several proportions of creosote oil and laid with the joints making various angles with the curb.

The methods of treating and laying the blocks are described in MUNICIPAL ENGINEERING, vol. xxxiv, p. 14, and a plat of the street is shown, giving the locations of the various test sets of blocks. There is also a table giving the results of traffic censuses taken on several days. The data of the experiment are also given, from the point of view of the government engineer, in Circular No. 141 of the U. S. Department of Agriculture.

The pavement has been in use for about three years, not long enough for a thorough test, but some judgment may be formed of the relative values of the woods from an inspection of the wearing surfaces. Mr. Andrew Rinker, the city engineer of Minneapolis, has rendered such a judgment and says that the indications are that the various woods should be arranged in the following order of preference for paving blocks: Southern pine, Norway pine, tamarac, white birch, hemlock, Western larch, and red fir.

Mr. Rinker thinks that for streets of

heaviest traffic Georgia pine should be used, and for streets of medium or light traffic Norway pine, tamarac, white birch or hemlock. He considers the fir a failure, possibly because a quick growth variety was used, for he expresses the opinion that if a closer fibred, slower growth variety had been used it would have come into the second class above named.

These results are interesting, but not particularly new, nor are they yet sufficiently differentiated to show the effects of the differences in amount of creosote and the effect of the other conditions noted.

Judging from some of the Indianapolis pavements, it will be necessary to wait more than ten years for complete data. The pavements made of blocks simply dipped in creosote, which was the earlier practice in Indianapolis, showed some of their defects within a few years, say four or five, particularly their strong disposition to swell when rained upon after a dry spell. Blocks which were treated with larger amounts of creosote lasted longer before showing the same defect, and those treated with specially refined oils intended to be as nearly insoluble in water and as nearly non-volatile at atmospheric temperatures as possible, lasted still longer. But no treatment has yet been able to withstand the protracted heat and drought of Indiana summers, and even the best pavements sometimes heave from expansion under water after a dry spell, whether in winter or summer.

However, the highest class pavements named are still first-class pavements, with surfaces practically as unbroken as at the beginning, some of them being fully ten years old. And some of the pavements made of dipped blocks are in almost as good condition after fifteen years or more of life. However, an appreciable proportion of the blocks in these latter named pavements have decayed and the cost of repairs to them seems to be materially greater. There is not sufficient detail of accounts to show exactly what is the difference in maintenance charges.

Mr. Rinker reports little trouble from swelling of blocks, and, notwithstanding somewhat higher cost, he reports that the proportion of creosoted block paving laid each year has increased from 54½ per cent of all pavements laid during 1906 to 75 per cent in 1909.

Further reports will be awaited with interest.

THE QUESTION DEPARTMENT

Night Soil Removal.

I am at present interested in the problem of the removal of excrement from the city by means of carts and would like to have any data or information you can give me along this line.

My present plan is as below given, but I would like any information bearing on the subject which you can furnish me with, as the project is in the formative state or stage.

The town will give a franchise (or exclusive contract), if legal, to some one who will undertake to remove from the city limits at stated intervals the excrement from houses, dumps, etc., and under his contract can collect from the citizens a certain toll or sum for the work.

In order to make it incumbent upon the citizens to patronize this person operating the carts, an ordinance will be passed making it necessary for all outhouses to be attended to at stated intervals, and the soil carried beyond the limits of the city. Under this ordinance the citizens would be forced to patronize the carts.

J. A. W., ————, S. C.

Chapin's "Municipal Sanitation in the United States" ($5) gives a full statement of the practice in many cities in the United States regarding the removal of night-soil, from the ordinances requiring and regulating the removal to the charges for the same and the method of collecting them. From this book the following selection is made.

If the city has no system of sewers and all the night-soil must be removed by carts

it will probably be simplest and cheapest to have the work done by contract or by day's labor under strict regulations made by the city. The cost of doing the work can be paid out of the city treasury from funds raised by taxation, since practically every one gets the service, or it can be assessed against those for whom the work is done at rates fixed by the ordinance.

Where there is a sewer system every one who can make connection with the sewer should be required to do so, reducing the cart service to a minimum. In such case those who receive the benefit of the cart service should pay for it. One of the simplest methods of securing good service is the following: The person desiring to have a vault cleaned applies to the proper authority, preferably the board of health. The sanitary officer ascertains the dimensions of the vault, either by inspection of his records or by inspection of the vault, and issues a permit for the cleaning, which states the fee which must be paid for the cleaning, the amount of the fee depending upon the amount of material to be removed. The applicant goes to the proper city official or to a bank designated and pays the fee. The permit is then an order on the contractor to clean the vault, and it is given to him or is deposited in a locked box by the receiver of the fee, from which these orders are taken by the contractor at stated times. If the work is done by the city, substitute foreman for contractor in the ordinance.

It is much better to have the work all done by a single contractor, but in any event the charges for the work must be fixed by ordinance and, in case there is more than one contractor the applicant for permit can choose his contractor from those licensed by the city.

Whether there are one or more contractors they should all be licensed by the board of health on evidence of ability to do the work carefully and according to regulations, and if there are several licensees they should either be put under bond or, which is better, be required to deposit some such sum as $25 or $50 from which the board of health can pay for any cleaning up or repair which the contractor fails to do himself within the limit of the time fixed by the ordinance for completion of a job. This time varies in different cities from two to five days. Should a contractor's deposit be drawn upon for such defects in his work, he should not be given any more orders for work until he has renewed it.

An inspector of the board of health should inspect each vault after it is cleaned, to check up its size for the office records and to see that it was properly cleaned and disinfected according to the ordinance or the regulations of the board.

At the end of each month the contractor can present his orders and the certificates of inspection of the work done under them and receive his pay at contract price, less any sum necessary to bring his deposit up to its full amount. He can be paid the full amount collected from the property owner or such smaller sum as may be agreed upon, part of the fee going to pay the city expense in looking after the matter. This method of paying the contractor and that of looking after the work are much more satisfactory than it would be to leave the arrangements and the settlement with the contractor to the property owner.

Regarding the methods of doing the work Dr. Chapin's book is quite full. The best method seems to be that of the odoriess excavator, which is an air-tight tank on wheels, a hand or gasoline pump capable of pumping up the material and forcing it into the tank, a charcoal fire through which to pass the air forced out of the tank by pumping the liquid in a suction hose to draw the liquid up, and hose enough to reach the tank wagon. This does good service at reasonable cost. Where little water reaches the vault or it is a leaching cesspool in dry ground, it may be necessary to pump or throw some water into the vault to make it possible to pump the material.

Far less satisfactory are water-tight barrels with air-tight covers which can be well fastened on, to be filled at the vault, carried to a wagon and hauled away. It is very difficult to keep the barrels clean on the outside and prevent odor from them as they are handled through the street.

All tanks, barrels and wagons should be thoroughly washed and disinfected immediately after emptying. All work should be done in the day time.

The night-soil can be used for fertilizing, but in its raw state requires some time for incorporation with the soil. One city provides for its deposit in trenches not less than 3 feet deep, layers not to exceed 3 inches in depth and to be fully covered with dry earth. By using a sufficient area of land a good share of it can be kept under cultivation all the time. Pits with the deposits covered with not less than 4 inches of earth and all the surrounding soil kept thoroughly clean require less area of ground but require longer time for disappearance of the nuisance of opening up the soil again.

Fees for the work run from $1.35 a cubic yard with a minimum charge of $3, to $5.40 a cubic yard.

The board of health doubtless has power to order the cleaning of a vault which has become a nuisance, or, if necessary, to have the work done under its own orders and assess the cost against the property to be collected with other taxes.

An inspector of the board of health can pass around and serve notices to clean vaults, similar in form to the permits described above. His inspection gives the size of the vault and he fills in the amount of fee to be paid. The property owner takes the notice and pays the fee to the proper city official, when the notice becomes an order to the contractor to do

the work, as in the case of the permit.

Dr. Chapin's book gives a number of forms of notices, permits, sets of regulations, etc., in use in various cities.

An article giving the practice in a number of cities on several of the points above covered will be found in MUNICIPAL ENGINEERING, vol. xxxv, p. 8.

Cost of Pipe Sewers.

I wish information regarding the prices of sewers of 8 and 10-inch pipe, properly laid in trenches, sometimes 10 feet deep, which must be braced in places and hard digging in general, fairly heavy work, with manholes and lampholes in the line. I would like the average prices in a few localities of such sewers laid to true grade by inspection.

M. J. D., Smethport, Pa.

Average prices for such sewers are given in the December number, vol. xxxvii, p. 398, viz., 75 cents a foot for 8-inch, 95 cents a foot for 10-inch, $30 to $40 each for manhole, and $10 to $15 each for lampholes. The following figures have been published in MUNICIPAL ENGINEERING:

Vol. vi, p. 81, Hannibal, Mo., in 19 contracts for 8-inch pipe sewers the contract prices ranged from 28¾ to 79 cents a foot, to which must be added engineering and supervision cost.

Vol. xviii, p. 110, has a table of cost of sewers, based on labor at $1.50, trench 18 inches more than diameter of pipe, day's work 11 cubic yards, no sheeting, no machinery, no water. For 8-inch pipe the cost of trenching, refilling and tamping is 16 cents for 6-foot trench, 22 cents for 8, 33 cents for 10, 44 cents for 12, etc.; cost of laying pipe is 5 cents. To this must be added cost of pipe delivered on the trench, cost of replacing pavements, if any, contractor's profit, allowance for water, sheeting, accidents, etc. Cost of laying 10-inch pipe is 5 cents also and cost of trenching, refilling and tamping is 18 cents a foot for 6 feet depth of trench, 23 cents for 8 feet, 35 cents for 10 feet, 47 cents for 12 feet, 59 cents for 14 feet, etc.

Vol. xxi, p. 40, has an article on cost of sewer construction which gives cost of 8-inch pipe as 8 cents, of 10-inch 13 cents a foot, within 50 miles of pipe factory, freight to be added for greater distances. There is a diagram giving cost of trenching, refilling and tamping, which gives 25 cents as the cost for 10 feet depth of trench for 8-inch pipe and 29 cents for 10-inch pipe. Sheeting is estimated to vary from 5 to 12½ cents a foot for trenches less than 10 feet deep and 25 to 75 cents for trenches 10 to 20 feet deep for driving and removing.

Vol. xxxv, p. 195, gives sheeting cost in Peoria as 10 to 25 cents per foot of trench for driving and removing, in trenches 8 to 16 feet deep.

Vol. xxx, p. 329, gives prices at Marysville, Kan., by contract as 50 cents a foot for 10-inch and 36 cents for 8-inch pipe, manholes $28 and lampholes $7. At Jefferson City, furnishing and laying 10-inch pipe cost 17 cents and excavation and back-filling cost 19½ cents if less than 6 feet deep; 25 cents if 6 to 8, 32 cents if 8 to 10, 42 cents if 10 to 12, etc., making 49 cents a foot for total of the two items for 10-inch pipe. Manhole cost $22 if 7 feet deep and $3 for each additional foot, or $17 if 10 feet deep. In another Jefferson City contract the cost of 8-inch pipe laid was 18 cents, and of trenching and back-filling 8 to 10 feet deep was 35 cents, making a total for the two items of 53 cents. Ten-inch pipe cost 37 cents a foot laid, which would make the total cost in trench 8 to 10 feet deep, 72 cents. Manholes cost $37 if less than 6 feet deep and $2.50 for each foot over 5 feet, making $49.50 if 10 feet deep.

A recent report of the New Orleans sewerage and water board shows the following: For 8-inch pipe laid by the city by day labor, 6 to 8 feet deep, the cost was 79½ cents; when 8 to 10 feet deep, $1.04; when 10 to 12 feet deep, $1.94. Ten-inch pipe 8 to 10 feet deep cost $2.37 a foot, and when 10 to 12 feet deep cost $2.91 a foot. These prices include everything complete. The average prices of manholes built under contract were $42.50 if less than 6 feet deep, $51 if 6 to 8 feet deep, $60.24 if 8 to 10 feet deep, $75.10 if 10 to 12 feet deep. The average contract prices for 8-inch sewers complete were 67 cents less than 6 feet deep, 82 cents if 6 to 8 feet deep, $1.09 if 8 to 10 feet deep, $1.46 if 10 to 12 feet deep, $2.13 if 12 to 14 feet deep. For 10-inch pipe the average prices were $1.18 if 6 to 8 feet deep, $1.48 if 8 to 10 feet deep, $1.87 if 10 to 12 feet deep, etc. Water is troublesome for nearly the whole depth of the trench in New Orleans and sheeting is expensive.

The last annual report of the city engineer of Salt Lake City, Utah, contains some figures of total cost of sewers, including manholes, flush tanks, etc. The 8-inch sewers in this list vary in price from 92 cents to $2 a foot. The flush tanks and manholes add from 20 to 25 cents a foot to the average cost of the sewer alone.

In Ogden's "Sewer Construction" ($3) several examples of costs of construction are given. In Atlantic, Iowa, trenching and back filling cost 14.8 cents a foot for 10-inch pipe in trench 6.6 feet deep; pipe laying cost 1.3 cents a foot. At Centerville, Iowa, trenching and back filling cost 28 cents for 8-inch pipe in trench averaging about 7½ feet deep and pipe laying 1.7 cents. This book would be of much value in posting up on the matters included in the question.

It will thus be seen that there are large variations in cost of sewers, due to conditions of which there are no statements, if, in fact, it were possible to make any statements. The general average prices stated in the first paragraph may be assumed as reasonably safe for any but most exceptionally difficult construction.

Cities Using Concrete Pipe Sewers.

We desire the names of towns and cities that have installed and are now installing sewer systems using cement or concrete pipe for other other than storm water sewers. W. T. W., Reidsville, N. C.

There are many articles in back numbers of MUNICIPAL ENGINEERING on this subject. Those in the July number, vol. xxxvii, pp. 34 and 35, give names of some cities and references to previous articles. The use of concrete sewers is now so general that the full list of cities using them would be very long. The following list may be taken as representative:

Mobile, Ala., storm, pipe.

San Francisco, Cal.; San Bernardino, water, pipe.

Denver, Colo., water, pipe.

Hartford, Conn., pipe and monolithic; New Britain, monolithic; Norwalk, pipe.

Dover, Del., pipe; Wilmington, combined and intercepting, pipe.

Savannah, Ga., storm, pipe; Macon, pipe.

Boise, Ida; monolithic.

Chicago, Ill., combined, pipe and monolithic; East St. Louis, monplithic; Mattoon, drainage, monolithic; Paris, plain and reinforced; Savanna, pipe; Waukegan, pipe.

Brazil, Ind., monolithic; Elkhart, pipe; Gary; Huntington, monolithic; Indianapolis, combined and intercepting, pipe and monolithic, plain and reinforced; Michigan City, pipe; Richmond, reinforced, pipe and monolithic; South Bend, reinforced pipe and monolithic; Wabash pipe and monolithic.

Boone, Iowa, concrete pipe; Cedar Falls, monolithic; Clinton, combined, monolithic, reinforced; Iowa City, plain pipe; Sioux City, monolithic.

Louisville, Ky., reinforced.

New Orleans, La., monolithic.

Bangor, Me., pipe; Portland, over 20 years old.

Baltimore, Md., sanitary, pipe and monolithic, reinforced.

Everett, Mass., monolithic and reinforced pipe; New Bedford, monolithic and pipe over 20 years old; Newton, monolithic; Springfield, monolithic and pipe 20 years old or more; Worcester, monolithic and pipe.

Battle Creek, Mich., monolithic; Bay City, monolithic and pipe; Coldwater, combined, concrete block; Ford, pipe; Grand Rapids, combined and drainage, pipe and monolithic, reinforced; Jackson, reinforced; Kalamazoo, monolithic; Manistee, pipe about 20 years old.

Albert Lea, Minn., monolithic; New Ulm, monolithic; Red Wing, monolithic.

Kansas City, Mo., monolithic; Lexington, monolithic; St. Joseph, combined, reinforced pipe.

Billings, Mont., reinforced pipe; Great Falls, combined, monolithic; Helena, pipe.

Concord, N. H., monolithic; Dover, monolithic and pipe, 15 years old or more; Portsmouth, monolithic and pipe.

Atlantic City, N. J., sanitary, reinforced pipe; Hoboken, very old; Newark, storm sewers and water conduits, monolithic and pipe, reinforced; Plainfield, reinforced block, pipe and monolithic; Rutherford, pipe.

Brooklyn, N. Y., combined, pipe, natural cement sewers 42 years old, Portland cement sewers about 10 years old; Haverstraw, reinforced pipe; Bronx boro, New York, reinforced monolithic; Watertown, pipe and monolithic, reinforced.

Chillicothe, O., monolithic and pipe; Cleveland, monolithic, pipe and block, reinforced; Columbus, combined and intercepting, monolithic and pipe, reinforced; Dayton, monolithic, reinforced; Lancaster, reinforced pipe; Norwood (Cincinnati), monolithic; Sandusky, monolithic and pipe, reinforced; Springfield, monolithic; Toledo, monolithic and reinforced pipe.

Toronto, Ont., water, reinforced pipe.

Portland, Ore., monolithic, and pipe 20 years old.

Allentown, Pa., monolithic; Altoona, monolithic; Clearfield, monolithic; Crafton (Pittsburg), reinforced pipe; Harrisburg, monolithic; Oil City, monolithic; Reading; Stroudsburg, monolithic; Williamsport, monolithic.

Pawtucket, R. I., pipe and monolithic; Providence, monolithic.

Columbia, S. C., storm, reinforced pipe.

Aberdeen, S. D., plain and reinforced pipe.

Knoxville, Tenn., combined and drainage, monolithic and reinforced pipe.

San Antonio, Tex., monolithic.

Salt Lake City, Utah, combined and intercepting, monolithic.

Bellingham, Wash., pipe and monolithic; Seattle, monolithic.

Baraboo, Wis., monolithic and reinforced pipe; Fond du Lac, monolithic; Janesville, reinforced pipe; Milwaukee, combined, nearly 50 years old, both natural and Portland cement, pipe and monolithic; Oshkosh, pipe; Superior, pipe; Tomah, drainage, reinforced pipe; West Allis, water, reinforced pipe.

Monterey, Mex., water, reinforced pipe.

Size of Sewer—Cost of Septic Tank.

1. What is the best size sewer to use in a town of 5,000 or 6,000 population? I mean the main sewer, first, then the size of the branches.

2. What is the best kind of pipe to use for same?

3. What would be the cost of a septic tank to handle the sewage from the same size town and what expense would there be operating same? B., ———, Okla.

1. The size of sewer depends upon the amount of water used, whether sewage only is to be carried or storm water also, the gradient of the pipe, etc. It is therefore not possible to answer this question definitely. No branch should be less than 8 inches in diameter, unless it is very short and has only one or two connections. The main sewer might be 10 or 12 inches in

diameter if the fall is heavy, or may be 15 to 18 inches in diameter if there is but little fall, and the sewers are used for house drainage only. If street drainage also is to be carried, no economical choice can be made without full information regarding rainfall, character of territory, pavements, system of grades, area covered, gradients possible in sewers, etc., etc.

2. Vitrified clay pipe is most commonly used. The use of well-made concrete pipe is growing. This question is to be answered most economically from a comparison of cost of the two kinds of pipe.

3. The cost of septic tank depends on location, amount of excavation or fill, necessity for protection from high water, and for extension of outlet sewer, whether a building is erected over it, method of discharge, etc. Possibly filters as well as septic tanks may be necessary. The tanks, with cheap building over them, will cost from $1,200 to $2,500, according to details required, and filter beds would perhaps double the cost, or more, if much grading is necessary to prepare them and it is necessary to pump the sewage to them. Tanks alone would probably not cost more than $50 a year for care, if they are put in charge of a city employe who has some spare time and he hires the labor occasionally necessary for cleaning and keeping in operation. The filters would require considerably more attention if they are needed.

A consulting engineer can easily save the town his fee by the saving he can make in cost of first construction or in later cost for reconstruction by his adaptation of the plans to the work to be done.

Ordinance Regulating Domestic Animals, Etc., in City.

I would like a copy of an ordinance regulating chickens, etc., running at large.

S. D. HODGDON, City Attorney,
Webster Grove, Mo.

Following is an ordinance which may cover the case:

1. *Be it ordained,* That it shall be unlawful for the owner of any bull, bullock, steer, cow, heifer, calf, horse, mare, colt, mule, jack, jenny, goat, sheep, hogs or swine of any kind, geese or ducks (or chickens), to suffer, permit or allow the same to run at large in any public street, alley or unenclosed commons of this city, or in any one of the public parks of said city. Any person violating any of the provisions of this ordinance, upon conviction thereof, shall be fined in any sum not more than $50.

2. It shall be the duty of the police to take up and impound all cows, etc., etc., found running at large within the corporate limits of this city, and to keep and confine the same in a proper pound, to be provided for that purpose, until redeemed or otherwise disposed of as hereinafter provided.

3. It shall be the duty of the Superintendent of Police to immediately give notice in writing to the owner of any animal taken up and impounded, if known to him; (if not known, method and places of posting notices are provided).

4. If the owner or owners of any such animal, so taken up and impounded under the provisions of this ordinance, at any time before the sale thereof, shall demand such animal, said Superintendent, upon payment first made of all costs, fees and expenses, shall surrender the same to such owner; but if any such animal shall not be, by the owner thereof, redeemed, and all fees, charges and expenses paid within five days after being advertised, as provided in Sec. 3 of this ordinance, it shall be the duty of said Superintendent to sell such animal at public auction to the highest bidder, for cash.

5. The proceeds arising from such sales, after the payment of all fees, costs and expenses, shall be by said Superintendent of Police paid into the city treasury, and such treasurer, upon proper evidence of ownership, shall pay the same to the owner of the animal sold; and if no owner or proper claimant shall appear within six months from the time the money was received, the treasurer shall cause the moneys so received to remain as part of the general fund of the city.

6. It shall be the duty of the Superintendent of Police to prepare a pound for the safe keeping of animals taken up and impounded under the provisions of this ordinance.

7. It shall be the duty of such Superintendent of Police to carefully attend to and provide the animals taken up with the necessary food and water, or cause the same to be done.

8. Said Superintendent of Police shall be allowed the following fees: For taking up and impounding each animal embraced within the terms of this ordinance, the sum of 50 cents per head (which shall be paid by the owner of such animal before the same shall be released), and the sum of 50 cents per head for every 12 hours or fractional part thereof in excess of 4 hours, in which such animal or animals are impounded, for the expenses of feeding and caring therefor. And said Superintendent shall be allowed the further sum of 25 cents per head for making sale. All such fees, costs and expenses shall be paid by the owner of such animal before it shall be released. In case of sale, the Superintendent shall have the right to retain the same out of the proceeds of the sale.

9. Appropriation for constructing pound.

10. Repealing former ordinances.

11. Date of taking effect of ordinance.

Some of the provisions of dog ordinances may be applied to other animals or birds. Dog ordinances will be found in MUNICIPAL ENGINEERING, vol. xxxvii, p. 38, and vol. xxx, p. 350.

In another city "stock limits" are de-

fined, within which it is not lawful for stock to run at large. There is also a penalty for taking stock from an enclosed lot and driving it to the pound; also one for breaking into the pound and driving animals out, each being $5 to $25, as assessed by police judge. Stock policeman receives $50 a month. Pound keeper receives fees. Fees for the pound are 50 cents for catching animal, 50 cents a day for taking care of horse, cow or like animal; 25 cents a day for hog, sheep, goat, or other small animal, also cost of advertising in case owner is unknown. A penalty of $5 for draft animals and $3 for cows and small animals is also assessed. Chickens, ducks, geese or other fowls are included in the ordinances, the penalties being $1 for a single fowl and $5 for a flock running at large alone. Other provisions are as in the ordinance above quoted.

Surveyor's Tapes.

Where can I get good tapes?

M. J. D., ———, Pa.

Names of manufacturers and dealers in steel and other tapes will be found in the "Business Directory," published in each number of MUNICIPAL ENGINEERING, under the headings "Steel Tape" and "Surveyors' Instruments."

Plans for Municipal Buildings.

Can you advise where I can get a book of sketch plans of municipal buildings. Also names of architects that would sketch up plans of a proposed municipal building with view of furnishing the final plans.

T. P., Borough Engineer, ———, Pa.

There are two American books answering the description as to requirements, one being Bicknell's "Public Buildings" ($2.50), and one Palliser's "Court Houses, Village, Town and City Halls, Jails, Etc." ($2.00). Clifford A. Tinker, 5 Elm Park block, Westfield, Mass., may supply the desired sketches.

Cost of Wooden Block Paving in Indianapolis.

I am told that there is a considerable amount of wood block paving in Indianapolis. Can you give us the names and addresses of any persons who would be able to give us figures as to costs, etc., of such pavements, laid in Indianapolis? We are anxious to obtain all possible recent data on this subject.

R. E. M., Cincinnati, O.

The bids for paving in Indianapolis are received upon the linear foot of length of each side of the street, and include all the work, excavation, curb, gutter, drainage appurtenances, foundation and wearing surface, and any extra areas of street and alley intersections, etc. Only an approximate idea of the cost of each item can therefore be obtained from a study of the bids and the plans and specifications. The city engineer is required by law to make an estimate of the cost of the pavement as a limit beyond which contractors cannot go in their bids. For the purposes of these estimates he has an estimate of the unit cost of each item. In MUNICIPAL ENGINEERING, vol. xxxvii, p. 152, is an article on "Cost of Pavements," in which the cost per square yard in Indianapolis for creosoted wooden blocks on 6-inch concrete foundation, with sand cushion and asphalt or tar filler, is given as $2.40. The article is based on statistics collected by a committee of the Illinois Society of Engineers and Surveyors, and gives prices for six cities, ranging from the Indianapolis price as a minimum to $3.49 at Chicago as a maximum. Another article on p. 177 of the same number gives a compilation of prices taken from the monthly reports in MUNICIPAL ENGINEERING of contracts awarded. In this the prices for creosoted wood block pavement vary between $1.75 in Detroit, Mich., and $3.72 in Pihladelphia, the Chicago price being quoted at $2.89.

It will be necessary to write to the boards of public works of the various cities for greater detail with respect to items and conditions, from which to determine the reasons for the variations in the quoted prices.

Design for Level Macadam Street.

Kindly send me list and prices of books on road and street making. The council here proposes putting in concrete curb and macadamizing the full width of the streets in the business section. The difficulty is that the town (2,000 population) is on a dead level plain and it is a hard matter to get drainage. By laying surface drains it is possible to get an outlet some half mile from the center of town. Is it practicable to make the center line of the street level and by putting in catch-basins at frequent intervals, to drain the street by false grading the gutters when they are made of macadam, and what should be the minimum fall for the gutter? Are concrete crossings a success on macadam roads?

H. E., ———, B. C.

Byrne's "Highway Construction" ($5); Baker's "Roads and Pavements" ($5); Aitken's "Road Making and Maintenance;" Morrison's "Highway Engineering" ($2.50); Spalding's "Text Book on Roads and Pavements" ($2); Elsden's "Roads" (5 shillings); Tillson's "Street Pavements and Paving Materials" ($5); Judson's "City Roads and Pavements" ($2), and "Road Preservation and Dust Prevention" ($1.50) are the principal books on road and street making, arranged in the order of their relative value for the conditions given in the letter.

If the street is kept reasonably clean and in good repair, the longitudinal sections can probably be worked out in some such way as that suggested. It is very seldom that there is not some such fall as 0.5 foot per hundred, and if there is so much a clean gutter will carry off the water. A good wide concrete or brick gutter will help much in the drainage, but

It will be necessary to keep the roadway in good repair next the edge of the gutter, so that the water will not stand along that edge or percolate too freely into the subsoil along its vertical surface.

In a business street the traffic should be fairly well distributed over the whole area, and it will be if the macadam is not too wide. The country traffic on such a street in a small town is often very heavy, so that it is not safe to make too definite a recommendation as to the width, but it is probable that 40 feet between curbs will be ample or more than ample, especially as it should have a commendable tendency to reduce the amount of hitching and standing of teams along the gutter, where the horses may soon dig out the macadam and give chance for much trouble.

The center line of the street can be made level or on a straight grade with a slight fall, if necessary, but the cross-drainage of the street will require the maximum usual crown at the points where the summits in the gutters occur, so that the crowning will be excessive where the gutters are deep. The writer has put two summits and three catchbasins on a nearly level block of asphalt pavement, on each side of the street, with reasonable success, keeping the center line of the street straight and on the average slope, because of a street car line. He would prefer, however, where it is possible, to give the street an undulating grade along the center, with summits at the centers of the blocks or other convenient points, and low points with catchbasins at the corners of the intersecting streets. In such cases the crowns can be varied both ways from the usual maximum, and the necessary fall to secure good drainage in the gutters can be increased or can at least be divided between the center line and the gutters, so that the crown and the depth of gutter will nowhere be excessive.

Concrete crossings on macadam roads can be made very successful. In a cold climate they must be made very deep and heavy and should be sloped off each way to make the attack of wagon wheels upon them as easy as possible. If the macadam is kept in good condition there will be no trouble, but even in earth streets, where the mud is sometimes very deep, the concrete crossings keep their places, if well constructed.

Manufacture of Paving Brick.

Will you kindly send me the title and price of some good publication on the manufacture of vitrified paving brick, and oblige? W. S. C., Billings, Mont.

There has not been much demand for books on the manufacture of vitrified paving brick, the literature on qualities and tests being sufficient for the engineers and other users of brick, and the technical part of brick manufacture being so modified by the qualities of the materials and the apparatus selected that no one has yet attempted to write a book giving the technology of paving brick manufacture. Some years ago Prof. H. A. Wheeler wrote a little book on "Vitrified Paving Brick" ($1), which give a good general description of the processes, and can probably be obtained, and W. W. Wallace wrote a still smaller book on "Brick Pavements" (50 cents), which also contains a brief description of the manufacture of the brick. Baker's "Roads and Pavements" ($5) gives a few pages to a brief description of brick manufacture.

Concreting in Freezing Weather.

I would like to have some information about using cement in freezing weather, how to help it resist the frost.

J. T. P., Carnegie, Pa.

The amount of cold which concrete will stand without injury is sometimes surprising, but when it is injured reconstruction is probably necessary, so that it is well to keep on the safe side. The small amount of heat necessary to protect the concrete during the time of taking its set is also quite surprising. Heating of the materials is often effective, but is not quite on the right principle, since the concrete is not likely to be injured during the process of mixing unless the exposure is greater than the men should be forced to stand, and the warmed materials are cooling during the process of mixing and placing, so that during the period of setting they may be reduced to a temperature too low for safety. Almost any sort of cover which is not too well ventilated, and a little heat, from steam pipe, salamander or even lantern, will do wonders in keeping the temperature of the surface, and therefore of the whole mass, high enough to allow the setting to take place, even if it is delayed by the low temperature. A brief discussion of the reasons for trouble from freezing of concrete will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 111. The results of some experiments on the effect of cold upon concrete are given on p. 114. The low temperatures of 41 and 34 degrees show higher strength of briquets than the higher temperature of 72 degrees, so that, if the temperature during setting can be raised barely above freezing point, better concrete than that obtainable in the summer results. On p. 380 is another article giving results of experiments with like showing, and also showing the results of keeping concrete at zero temperature for various periods and then raising the temperature to 70 degrees for one and seven days. Several methods of preventing freezing are described in detail, including salt for temperatures above 22 degrees, heating materials and protecting the top of the work. A combination of the last two is considered the best. Forms should be kept on much longer in cold weather and not removed until close inspection shows that removal is safe. Other articles will be found in earlier numbers.

Arc and Other Electric Lights.

Will you kindly give us information regarding incandescent, tungsten and tantalum street lighting, as compared with arc street lighting? This town is now partially lighted by arcs, and the city council now has under consideration the matter of changing the system for the greater part of the town, population 6,000, to incandescent. H. C. C., ———, Wash.

It will hardly be possible to answer this general question within the limits of this department. Reference must be made to articles upon various phases of the subject which have already appeared in MUNICIPAL ENGINEERING, and to others appearing in this number. A few general statements may be made in the way of the comparisons desired with respect to some of the important items, leaving more detailed discussions for answers to more specific questions.

There are three or four important subjects which present themselves at the beginning. One is the relative cost of installations for producing and distributing the light, which can scarcely be discussed with any satisfaction without more information than is given in the above letter. Another is the relative cost of maintenance and operation; another is the kind of illumination that is desired and the resulting distribution of lamps; another is the relative efficiencies of the various lamps. These are all interdependent and affect the question of cost of construction and operation. The following notes regarding them will perhaps be of interest and may lead to more detailed discussion and reference to discussions already printed. Most of them are taken from the *General Electric Review* and the *Illuminating Engineer*.

Dr. H. Lux has prepared a table of efficiencies of the most common sources of light, from which the following figures are taken:

Kind of Lamp.	Consumption of Energy in Watts.	Mean Spherical Candle Power.	Watts Consumed per Mean Spherical Candle (Hefner).
Electric carbon filament glow, with globe	98.2	24.5	4.09
Nernst, without reducing rheostat	165.0	94.9	1.74
Tantalum	44.0	26.7	1.65
Osram	38.3	27.4	1.42
Direct current arc	435.0	524.0	0.83
Direct enclosed arc	541.0	295.0	1.31
Flame arc, yellow	349.7	1145.0	0.31
Flame arc, white	348.0	760.0	0.46
Alternating current arc	180.6	89.0	2.03

A comparison on the basis of average cost is made by C. Henry Irvin. He assumes for a 17.7 c.p. incandescent lamp an efficiency of 3.1 watts per candle power and a cost of 10 cents a kilowatt hour, making a lamp burning 90 hours a month cost 2.8 cents per candle power per month, which, apparently, makes a small allowance for maintenance. The 165 c.p. Nernst lamp, with an assumed efficiency of 1.6 watts per candle power and a maintenance cost of 6 cents a kilowatt hour, will cost 1.52 cents per candle power per month, other conditions being as above.

The 200 c.p. arc lamp, with an efficiency of 2.3 watts per candle power, will cost 1.35 cents per candle power per month.

In MUNICIPAL ENGINEERING, vol. xxxiii, p. 348, is a comparison of cost of operating three kinds of arc lamps. The first installation was a 125 h.p. engine, operating four Jenney 25-ampere generators, using 115 i.h.p., and 78 2,000-c.p. open arc lamps, costing $80 per lamp per year. The engine remaining the same, the lighting apparatus was replaced by a No. 12 General Electric Brush 6.6 ampere generator, using 101 i.h.p., and 116 2,000-c.p. enclosed arc lights, costing $56 per lamp per year. Later this system was replaced by a No. 13 General Electric Brush generator, using 78.6 i.h.p., and 132 magnetite lamps, costing $47 per lamp per year for operation. With the same engine that operated 78 open arc lamps, 155 magnetite lamps will be operated.

The committee on street lighting specifications of the National Electric Light Association made a comparison of arc lamps in terms of 16 c.p. incandescent lamps. A 4-ampere, direct current, series, luminous arc lamp is equivalent to 30¼ 16-c.p. incandescents. A 9.6-ampere, direct current, series, open arc; a 6.6-ampere enclosed arc; and a 7.5-ampere, alternating current, series, enclosed arc, are each equivalent to 16 of the 16-c.p. incandescents. A 6.6-ampere, direct current, series, open arc; a 5-ampere enclosed arc; and a 6.6-ampere, alternating current, series, enclosed arc are each equivalent to 12¼ of the 16-c.p. incandescents. A 5.5-ampere, alternating current, series, enclosed arc is equivalent to 9 of the 16-c.p. incandescents, installed in the same place in each case.

In MUNICIPAL ENGINEERING, vol. xxxvi, p. 216, is a comparison of tungsten lamps with arc lamps. In brief, the statement is made that 10 of the 32-c.p., 8 of the 40-c.p., or 5.3 of the 60-c.p. tungsten lamps can be operated with the same power that operates one alternating current enclosed arc lamp. On account of the better distribution of light the author assumes that 3 60-c.p. tungsten lamps will give better service than one arc lamp. He assumes the arc lamp to cost $80 a year, and, allowing for extra lamp supports and apparatus, he computes the rate for the tungsten lamps at $22 each, or $66 for the three which displace the one $80 arc lamp.

Oliver F. Bristow gives an example of

the value of substitution of tantalum lamps for carbon filament lamps. He states that the watt meter showed the 16-c.p. carbon filament lamps to be taking 65 watts each, or 4.01 watts per candle power, while the 20-c.p. tantalum lamp required 40 watts, or 2 watts per candle power (compare with the above table). The estimated gain in capacity by substitution of an equal number of tantalum for carbon lamps was 25 kilowatts, which is estimated to be worth $2,500. Interest, depreciation, taxes, and cost of operation of this capacity is computed at $700, while the difference in cost of the two kinds of lamps, assuming 1,000 lamps in service, is $340, leaving $360 for the trouble of making the change and for profit.

The University of Illinois has made tests of carbon filament, metallized carbon filament, and tantalum lamps, with reference to various important characteristics, two of the conclusions being as follows: The same electric energy is required to operate a 16-c.p. carbon, a 20-c.p. metallized carbon and a 22½-c.p. tantalum lamp, and the number of lamps of each, with the same candle power, operated by the same current, would vary in the inverse order. The carbon lamp has reduced to 80 per cent. of its original candle power in 400 hours of use, the metallized in 780 hours, and the tantalum lamp in 820 hours, under good operating conditions. Under bad operating conditions, fluctuating currents, etc., the lives were 225, 350 and 350 hours, respectively.

Frank W. Willcox makes a detailed comparison, which results in the statement that the total cost of power and lamps per 100 candle hours at 10 cents a kilowatt hour for power is 3.63 cents for a 16-c.p. 50-watt carbon filament lamp; 2.93 cents for an 18-c.p. 50-watt metallized carbon lamp; 2.43 cents for a 20-c.p. 40-watt tantalum lamp, and 1.71 cents for a 40-watt tungsten lamp. These are merely examples of the many conditions covered in the author's comparisons.

The general principles of street lighting on which the choice of lamps for various districts in a city should be based are well stated in the article on "Street Lighting," to be found on another page in this number of MUNICIPAL ENGINEERING. Many other articles will be found in preceding volumes.

Plans for Concrete Conduit.

This city intends having constructed a 5-foot concrete conduit about 1,400 feet long, with a 5-foot gate valve, for the purpose of disposing of storm waters. Will you please send me, as a subscriber of your paper, some plans and specifications for such work, with contract? I desire to have something that has been approved. H., City Attorney, ——, Miss.

It would not be safe to accept plans for such a conduit made for one place under conditions quite probably different from those existing here, especially if there is to be a gate under pressure, and liable to the troubles which gates and their surrounding structures may have. The only safe way in so important and expensive a work as this seems to be is to secure a competent engineer to make a careful inspection and survey of the work to be done, upon which to base plans and specifications, and he can work out with the city attorney, who is familiar with the laws of Mississippi, the terms of a contract with some one who will undertake the work under these plans and specifications. The engineer will be worth his fees in the savings he will make in the construction cost if the work is made heavier than necessary, or in damages and cost of reconstruction if the work should be built too cheaply and should fail.

Some idea of what others have done in the way of building 5-foot conduits and in making specifications and contract for the work may be gained from a perusal of the following articles in MUNICIPAL ENGINEERING:

Vol. xxxvii, p. 145: "The New Pittsburg Filters," showing a photograph of the large reinforced concrete filtered water conduit under construction.

Vol. xxxvii, p. 289: "The Los Angeles Aqueduct," showing photograph and plans for concrete channel and tunnel somewhat larger in dimensions.

Vol. xxxvi, p. 21: "Concrete Sewer Construction in Chicago," describing the construction of a concrete sewer varying in diameter from 4½ to 5½ feet.

Vol. xxxvi, p. 220: "Planning the Clinton Sewers," giving the principles of the design of concrete and reinforced concrete conduits from 4 to 10 feet in diameter.

Vol. xxxvi, p. 297: "The College Avenue Sewer, Indianapolis, Ind.," giving description and photographs of construction of concrete sewer 2½ to 8 feet in diameter.

Vol. xxxvi, p. 300: "Methods of Sewer Construction in Clinton, Iowa," giving quite detailed instructions for the work of building brick, plain concrete and reinforced concrete sewers or conduits, including 5-foot circular plain concrete.

Vol. xxxv, p. 71: "Methods and Cost of Constructing Concrete Sewer" 7 feet in diameter.

Vol. xxxv, p. 148: "The Big Cottonwood Water Works Conduit of Salt Lake City, Utah," somewhat less than 5 feet in diameter, illustrated.

Vol. xxxiii, p. 73: "The Metropolitan Water Supply System," giving several forms of conduit construction for the Boston water supply.

References to earlier articles will be found in vol. xxxiii, p. 252.

Much information on the subject can be obtained from such books as Taylor and Thompson's "Concrete, Plain and Reinforced" ($5) and Gillette and Hill's "Concrete Construction Methods and Cost" ($5). The best form of specifications for such work will be found in the "Hand-

book for Cement Users" ($3), from which a set suited to the special conditions can readily be selected.

Elsewhere in this number of MUNICIPAL ENGINEERING will be found extracts from specifications of the United States Reclamation Service for a reinforced concrete conduit 4 feet in diameter, part of it under pressure of as much as 50 feet of water. Possibly the conduit proposed by our correspondent could be made of plain concrete more economically, especially such parts of it as are not under pressure of water from within nor of water or earth from without.

Filtering Intake for Water Supply from River.

My company is bound to put in a better, clearer water in future, and I suggested putting in a percolation system in the Ohio river. A number of them are used, and while this system may not be at all advisable in some other rivers, we have the ideal location, there being coarse sand not less than 20 feet deep, and the percolation shells can be sunk and connected to suction main at less cost than any mechanical filter. I give you a crude sketch herewith, and if you can give some information on the subject and the name of a reliable contractor, I will appreciate your effort to assist me.

A. S., ———, Ky.

The sketch shows a pump well with a suction lift of 25 feet at extreme low water, an 18-inch suction pipe 450 feet long, extending under the bed of the river to a double row of cast iron shells, each 4 feet in diameter and 6 feet long, set in pairs, shells being 12 feet from the suction pipe on each side and the pairs 12 feet apart, and connected with the suction pipe by 12-inch pipes. It is estimated that ten of the shells will have a capacity of 2,000,000 gallons in 24 hours.

Can our readers give any suggestions regarding the proposed method of getting water?

The following questions suggest themselves:

Is not the suction lift too great in case the wells close up so that draft on them is difficult? Would better results be obtained if the pump well were deep enough so that the pipe from the shells drained by gravity to it, especially in length of life of the wells? Would ordinary 6 or 8-inch driven wells in larger numbers be preferable to the 4-foot shells in cost, ease of installation and ease of removal for cleaning? Could each of the shells be set over some well-strainers extending down toward the bottom of the sand stratum, thus increasing the area of sand from which water could be drawn?

This latter suggestion calls to mind the horizontal wells which are sometimes used in similar circumstances when the depth of sand is not sufficient to give the length of strainer necessary for good flow from vertical wells. By driving the pipes horizontally, say 25 feet apart, strainers 30 feet long or more can be put at the ends of, say, 6-inch suctions pipes connected up to 8, 10 or 12-inch branches from the main suction pipe.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

An Experience with Cement Lined Pipe.

In a recent paper, Leonard Metcalf, consulting engineer, of Boston, cites the experience of the city of Waltham, Mass., in the use of cement lined pipe, which, though now abandoned, was in use long enough to present some very interesting results, as here presented.

Waltham had a population in 1905 of 26,282. Water works were constructed in 1872, the mains being cement lined pipe. In 1887 the further use of this pipe was practically abandoned, and since that time substitutions have been made until at the present time there is left only about one mile of cement pipe. In 1887 there were about twenty miles of cement lined pipe, ranging in size from 4 inches to 16 inches. The reason given for giving up the use of this pipe was leaks in the joints, also trouble in making connections and care necessary in opening and shutting gates to prevent water hammer, which is liable to cause breaks.

On July 4, 1879, lightning caused the

destruction of 300 feet of 6-inch pipe, cast iron being substituted at a cost of $263. July 12, 1883, lightning again caused a small leak, and it was repaired at a cost of $20. August 3, 1889, 32 feet of 4-inch pipe was destroyed, and on August 12, 1891, 1,070 feet of 6-inch pipe was destroyed by lightning.

The Waltham report for 1895 contains reference to electrolysis in connection with the cement lined pipe, and states that several pieces dug up near the electric car tracks were badly pitted and that the pipe was rendered practically worthless.

During this period there were about twenty miles of cement lined pipe in the system.

Year.	No. of Leaks in Cement-Lined Pipe.	Total No. of Leaks.	Cost of Repairs on Cement-Lined Pipe.	Cost Per Leak.	Cost Per Mile.
1883	13	19	$232.00	$17.84	$11.60
1884	15	27	245.00	16.33	12.25
1885	6	13	45.00	7.50	2.25
1886	7	12	400.00	57.15	20.00
1887	5	12	154.00	30.80	7.70
1888	8	10	179.00	22.38	8.95
1891	37	41	1,092.00	29.52	54.60
Average	13	19.1	$353.30	$25.79	$16.76

The large number of leaks noted in 1891 was partly due to the beginning of construction of a sewerage ssytem in the city. Laborers, in digging trenches for sewers, caused damage to the water pipes. It should be noted that the cost of repairs given in the above table generally includes the substitution of cast iron for the old cement lined pipe.

U. S. Specifications for Reinforced Concrete Pressure Pipe.

Following are selections from specifications governing the construction of reinforced concrete pipe under pressure varying from zero to 60 feet head of water, selected from specifications prepared for the Buford-Trenton project in North Dakota by the United States Reclamation Service.

The general conditions, not given, cover such subjects as form of proposal, certified check, bonds, definitions of terms, methods of laying out work, materials and workmanship, suspensions, delays, unit prices, changes, extra work, inspection, defects, etc.

The general provisions describe the work to be done, list the drawings, define times of commencement and completion, manner of making payments, divisions of the work, and include specifications for other work than that selected below.

EXCAVATION.

Description.—The price stipulated for excavation shall include the cost of damming, pumping, bailing, draining, sheeting, bracing and all other work necessary to maintain the excavation in good order during construction.

Classification of Material.—All material moved in grading shall be measured in excavation only, and estimated by the cubic yard under the following classes:

Class 1. All material that can be plowed by a six horse or six mule team, each animal weighing not less than 1,400 pounds, attached to a suitable breaking plow, all well handled by at least three men; also all material that can, without plowing, be handled in scrapers, including all detached masses of rock two cubic feet or less in volume.

Class 2. All detached masses of rock more than two and less than twenty cubic feet in volume, and all indurated material and hardpan, if any, that cannot be plowed as described under Class 1, but that requires loosening by powder and can then be removed in scrapers.

Class 3. All rock not included in above classes that requires drilling and blasting.

Class 4. All excavation below the plane of saturation.

Overhaul.—All material taken from the excavation and required for embankment or other purposes must be placed where directed by the engineer. The limit of free haul shall be 200 feet. All haul of over 200 feet, where the material is needed for embankment or other purposes, will be paid for at the rate agreed upon in the contract per cubic yard per hundred feet of additional haul, but no allowance will be made for overhaul where the excavated material is wasted, except where such overhaul is ordered by the engineer. The length of haul shall be understood to mean the distance from the center of gravity as found in excavation to the center of gravity of the material deposited, leaving out of consideration the material that is excavated and deposited between the same two adjacent stations.

Clearing, Grubbing and Preparation of Surface.—The surface of all excavation that is to be used for embankments and the ground under all canal embankments must be stripped of all brush and vegetable matter of every kind; the stumps and roots of shrubs shall be grubbed to a depth of six inches below the surface of the ground and burned with the other combustible material removed, and the ground under the embankments shall be well plowed. Where the ground is free from trees and shrubs, the cost of the preparation of the surface will be included

in the price bid for excavation. Where the ground is covered with a growth of trees and shrubs the work will be paid for at the price bid per acre for clearing and grubbing, and will be estimated under the following classes, but in no case shall any area be considered as belonging to more than one class:

Class 1. All shrubs of the size and nature of the so-called rose bush and buck brush that can be readily cut by a suitable machine and the ground plowed by a team.

Class 2. All shrubs of the size and nature of the so-called basket willow and kinnykinic.

Class 3. All shrubs of the size and nature of the so-called boxelder, diamond willow, and ash up to a diameter of six inches, measured not more than one foot above the surface of the ground.

Material Laid Aside.—Where any material suitable for use in structures, such as sand, gravel or stone, is found in the excavation, it shall, if so ordered by the engineer, be laid aside in some convenient place designated by him. No extra allowance will be made for this work except for required overhaul.

Riprap.—Riprap will be required in the vicinity of pressure pipes, culverts and structures at the creek crossings, and also at such places as the engineer may direct. The riprap shall be laid upon a foundation of gravel or small stones six inches in depth. Upon this foundation the riprap shall be laid by hand, with the base of each stone bedded in the foundation and with the top conforming to the grade of the surface required. All spaces between the stones used for riprap shall be filled by smaller stones and gravel. The riprap shall be from six to twelve inches thick, as directed by the engineer, and no stones shall be of less depth than the thickness required. In computing the volume of riprap, the depth will be the required distance between the surface of the rock and the bottom of the gravel foundation, and payment will be made at the price bid per cubic yard for the material in place.

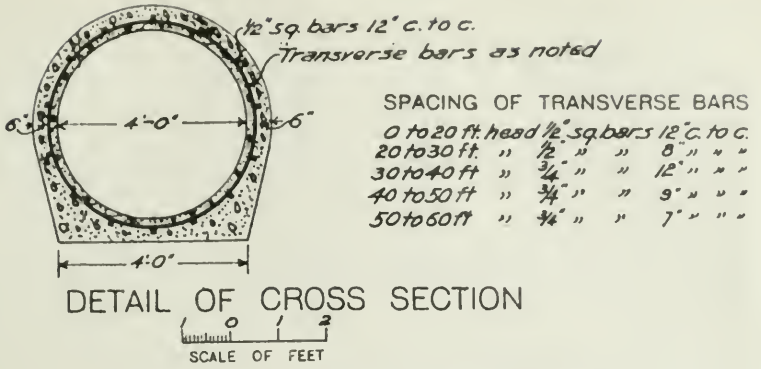
CONCRETE.

Classification and Payment.—All concrete will be divided into the following two classes: Class 1, Plain concrete; Class 2, Reinforced concrete. Only that portion of any concrete wall or structure will be considered as belonging to Class 2 that actually contains steel reinforcement. Concrete of the class specified will be used in such places and shall be of such forms and dimensions as may be shown on the plans or ordered by the engineer. When the conditions make it desirable to reinforce the concrete by the use of imbedded steel, the details will be shown on the plans or furnished by the engineer. The price bid per cubic yard for concrete under Class 1 shall include all necessary forms, protective work and pumping, the furnishing of all material except cement, and haulage of all material, including the cement. The price bid for concrete of Class 2 shall include, in addition to the above, the hauling, cutting, bending, welding, wiring and placing of steel for reinforcing.

Cement and Reinforcing Steel.—All cement and all steel for reinforcement will be furnished by the United States. They will be delivered to the contractor f. o. b. cars at the railroad station most convenient to the work. The contractor will be held responsible for demurrage to the railroad company, and shall haul the cement and steel from the railroad station to the work. He shall furnish suitable warehouses or sheds for storing the same until used, and will be held responsible for any loss of or damage to cement or steel after their delivery at the railroad station. If the cement is shipped in sacks, the contractor will be held responsible for the return of the full number of sacks to the railroad station in serviceable condition, and for all sacks not so returned he will be charged at the rate paid by the United States. The contractor must give the engineer at least sixty days' notice in writing as to when and where he wants cement delivered, and shall state the amount required, which must be expressed in carload lots, as far as practicable.

Sand.—The sand shall be composed solely of hard, durable particles, and must not contain more than 10 per cent. of clay. All the sand shall be of such size as will pass through a screen with a clear one-quarter-inch square mesh, and shall be so graded that the voids in the dry, well-shaken material shall not exceed 35 per cent. of the mass.

Mixing.—If the concrete is mixed by machine, such machine and its operation shall at all times be subject to the approval of the engineer, and if at any time it fails to perform the mixing in a satisfactory manner, it must be removed at once and another machine substituted therefor. If hand labor is used, the mixing of the concrete shall be done in the following manner: A tight floor, either of planks or sheet iron, shall be used for the mixing in all cases. The sand shall first be piled on the floor with the cement in the required proportions. The mass shall then be shoveled over as many times as are necessary to make a thorough mixture of sand and cement. Sufficient water shall be added to make a stiff mortar and the mass shoveled over once or twice more, as may be necessary. The stone or gravel, which shall be well wet, shall then be added, and the entire mass shoveled twice or more before shoveling into the carriers. Concrete shall be mixed in such small and convenient quantities as will allow it to be used very soon after being mixed; and any portion of a batch that has acquired initial set before being placed must not be used, and must be removed at once from the vicinity of the work. In no case will concrete be permitted to re-


½"sq. bars 12" c. to c.
Transverse bars as noted
6"
4'-0"
6"
4'-0"
SPACING OF TRANSVERSE BARS
0 to 20 ft. head ½" sq. bars 12" c. to c.
20 to 30 ft. " ½" " " 8" " " "
30 to 40 ft " ¾" " " 12" " " "
40 to 50 ft " ¾" " " 9" " " "
50 to 60 ft " ¾" " " 7" " " "
DETAIL OF CROSS SECTION
0 1 2
SCALE OF FEET

REINFORCED CONCRETE PIPE UNDER PRESSURE.
Buford-Trenton Irrigation Canal, North Dakota.

main in the work if it has begun to set before tamping is completed.

Water for Mixing.—The water used for mixing shall be reasonably clean and free from organic matter.

Gravel or Broken Stone.—Stone for concrete shall be sound, clean gravel or broken rock approved by the engineer. Except where otherwise specified, it shall be of such sizes that it will pass a screen having two and one-half inch round holes and be retained on a screen having one-quarter inch square holes. The finer particles passing through the one-quarter inch screen may be used as sand in forming the concrete, when complying with the requirements of paragraph on sand, above.

Proportions of Materials.—The proportions of materials in concrete for each piece of work shall be such as may be required by the engineer.

Placing.—Under no circumstances shall concrete be laid in deep or moving water or on a muddy foundation. When so ordered by the engineer, suitable foundations of broken stone, gravel or timber shall be provided by the contractor and will be paid for by the United States as extra work. All surfaces upon which concrete is to be laid shall be clean and thoroughly wet before the concrete is deposited. All concrete shall be well tamped, if put in "dry," with heavy tamping bars, until a film of water appears on the surface; and if "wet," with suitable bars, shovels or other implements, so that porosity and rough surfaces may be avoided. Concrete shall be used "wet" whenever practicable, and "dry" only when the nature of the work renders such use unavoidable. No concrete shall be placed during freezing weather unless special permission is granted by the engineer, in which case it shall be mixed, placed and protected in such manner as he may direct. No extension of time will be allowed the contractor for delays in concrete work due to freezing weather. In finishing a day's work or whenever leaving a face of concrete to which other concrete is to be joined, a suitable key, or bond, satisfactory to the engineer, of such dimensions as may be required to insure a strong, water-tight bond shall be left in the surface or face of the concrete. Whenever new work is joined to old, the surface or face of the old work shall be thoroughly cleaned of all dirt or loose matter of every kind, thoroughly wet, and coated with neat cement as the new work is started. The pressure pipes or other structures in which watertightness is essential shall be built in monolithic sections of such lengths that the work in a section may be completed during one working day. Whenever steel is imbedded in concrete special care shall be taken in ramming the concrete around the steel to secure perfect contact between them without disturbing the steel.

Inspection.—All concrete shall be mixed and laid in the presence of an inspector and to the satisfaction of the engineer.

Protection.—The contractor shall keep all concrete wet by sprinkling with water, or by covering with earth or other material, or both, as directed by the engineer, until the cement is sufficiently set. He shall provide such facilities for protection of finished work as may be required to secure satisfactory results.

Finishing.—The inside surfaces of all conduits and approaches forming part of the waterway of the canal shall be given a smooth finish by proper manipulation of the concrete and by using planed lumber with tight joints for forms. Immediately upon removal of the forms, voids, if any, shall be filled with mortar and all exposed surfaces shall be given two coats of cement grout evenly applied with a suitable brush.

Forms.—Centers and other forms shall be smooth, true to shape, and strong enough to withstand without movement the strain of ramming the concrete against them. The lagging used shall be of even thickness, planed on the edges and on the side next to the concrete, and shall be placed with tight joints.

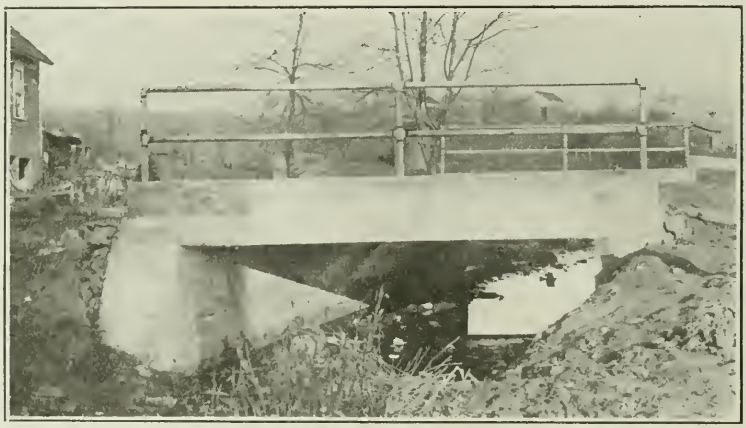
Anchorage of Steel Bars.—In pressure pipes the transverse bars shall be welded at the joints so as to form continuous rings. In other cases the bars shall be anchored in the concrete by bending or other deformation, and at splices or joints bending or wiring, or both, will be required. The cost of all work of this nature shall be included in the price bid for concrete of Class 2.

Pressure Pipe.—From the pumping station there shall be constructed a pressure pipe of reinforced concrete, about 2,700 feet long, leading to Canal "A." The interior diameter of this pipe will be about four feet, and it shall be constructed as shown on drawing. It must be built in complete sections of such lengths as can be finished each day. The forms, methods of placing concrete, and tamping or shaping must be satisfactory to the engineer. When a section is commenced, it must be carried through continuously without delay in setting forms or placing concrete, so that there will be no tendency to form seams or cleavage planes. The vertical joints between sections shall be roughened or mortised to the satisfaction of the engineer, and the longitudinal reinforcing rods must be left projecting from each section. After the forms are filled with concrete, they must be kept saturated with water, and immediately after the removal of the forms all voids in the concrete must be carefully filled with mortar and the inside of the pipe must be given two coats of cement grout applied with a brush. The outside surface of the pipe must then be protected from the sun by covering with earth or other suitable material, and the covering must be kept saturated with water until the backfilling over the pipe is in place. The concrete shall be mixed and placed as provided in paragraphs above. The pressure pipe shall be reinforced with steel as shown on drawing. The steel shall be placed under the requirements of paragraphs above. The trench for the pipe shall be excavated to such lines as to give sufficient room for the necessary forms and for spading and tamping the concrete. After the outside forms have been removed the trench shall be refilled, and to the elevation of the top of the pipe the material shall be thoroughly compacted by tamping or some other method approved by the engineer. The cost of all work of this nature shall be included in the price bid per cubic yard for "trenching and backfilling." The pressure pipe will be paid for at the price bid for "trenching and backfilling" and concrete for the classes required.

Cost of Concrete Culvert.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The skew culvert shown in the accompanying photograph has a straight span of 12 feet, the face on the skew is 17 feet long, and the abutments are 32 feet long. There is a 6-inch concrete paving in the bed of the stream. The abutments extend to good foundations and are 3 feet thick to top of the paving and then taper to 2 feet at the base of the slab which is the concrete floor, 12 inches thick and reinforced with 19 60-lb. rails, each 13 feet 6 inches long, and of the full outside dimensions above given. Parapets are 12 inches high and 5 inches thick, on which are set the pipe railings.



REINFORCED CONCRETE BRIDGE AT INDIANA, PA.

The concrete was mixed by a Smith mixer and all put in place in one day of 10 hours. Wages on the work, laborers, $1.50 per day; foreman, $3.00; machine man on mixer, $3.00.

The following table gives the cost in detail:

	Cost.	Per yd.	
Excavation	$38.50	$0.5661	
Cement	81.60	1.200	At $1.20 per barrel.
Sand	47.80	.703	At $1.25 per ton.
Stone	95.60	1.406	At $1.25 per ton.
Forms	25.00	.3676	
Placing forms	15.50	.228	
Mixing	57.50	.846	Mixing and depositing.
Steel rails	76.80	1.129	Railroad rails at $30 a ton.
Carting	8.00	.118	
Incidentals	8.15	.120	
	$454.45	$6.683	Total yardage, 68 cu. yds.

The culvert was designed by Thos. Pealer, borough engineer, and built by M. Bennett & Sons, contractors, Indiana, Pa. The pipe railing was put on by the borough and was not in the contract for the culvert.

THOS. PEALER,
Borough Engineer, Indiana, Pa.

MUNICIPAL MATTERS IN COURT

Higher Courts—Damages by Power Plant—Iowa City Debt Limits—Utica Water Rates

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY-AT-LAW, INDIANAPOLIS, IND.

Contract With Architect—City Can Not Reduce Compensation.—When a city agrees to pay a firm of architects a certain percentage on the cost of construction of a fire and ice boat, in consideration of their services in preparing the plans and specifications for the boat, the city can not reduce the compensation agreed upon after the architects have done their work by eliminating the fire features of the boat and thereby reducing its cost of construction.—Melville v. City of Philadelphia (Pa.), 38, Pa. Super. Ct. 326.

Condition in Contract Requiring Guarantee of Uninterrupted Supply of Brick is Proper.—A condition of an advertisement for bids for street paving, requiring the bidder to furnish a certificate from the manufacturer of the brick to be used guaranteeing an uninterrupted supply within the time fixed for completing the contract, was not unreasonable, but proper.—O'Neill & Viscount v. City of Elizabeth (N. J.), 73 A. 872.

Contractor's Guarantee of Pavement Contemplates Use of Street by Street Railway.—Where at the time a contract for paving a street was made which contained a guarantee by the contractor to maintain the pavement in good condition for ten years, making all necessary repairs without further charge, a street railroad was being operated on the street, the contract must be presumed to have been made in the light of such fact, and the contractor cannot avoid obligation on its guarantee on the ground that the pavement was broken because of the insufficiency of the foundation of the street railway tracks, nor because during the ten years the city renewed the grant to the street railway company, nor because heavier cars were used by such company, all of which must be presumed to have been within the contemplation of the parties.—City of Akron v. Barber Asphalt Pav. Co. (U. S. C. C. A., Ohio), 171 F. 29; Barber Asphalt Pav. Co. v. City of Akron, Id.

Legality of Contract Not Affected by Illegal Assessment to Meet Payment Therein Provided.—In an action by a city on a guarantee, in a contract for paving, that the contractor would keep the pavement in repair for ten years, where the contractor received payment for the work in full, it has no interest in the source from which the money was obtained which entitles it to set up as a defense that the contract was illegal because the city made a special assessment on abutting property for the entire contract price of the work, although it had no power to levy such assessment for repairs, it having undoubted power to contract for the repairs and to pay for the same from its general fund.—Id.

Overflow of Water Arising from Changes in Character of Surface of Streets

—City Not Liable.—A city is not liable to a property owner for the increased flow of surface water over or onto his property, arising merely from the changes in the character of the surface produced by the opening of streets, building of houses, etc., in the ordinary and regular course of the expansion of the city.—Barrett v. Minersville Borough (Pa.), 38 Pa. Super. Ct. 76.

Departure from Contract Fixing Grade of Sewer—Insufficient Cause for Enjoining Assessment.—Where by the inadvertence of the engineer employed to fix the grade of a sewer, the contract has been departed from as to its depth, without affecting its cost or efficiency, and the error is not discovered until after the completion of the work, an assessment will not for that reason be enjoined, no substantial injury to the lot owners being apparent.—Close v. Parker, 30 Ohio Cir. Ct., R. 384.

Adoption of Road as Street—Discretion of City Authorities.—When a city acquires the property of a plank road or turnpike company, the duty which it assumes is to keep the highway in repair, and the character of the highway is not changed. The city may adopt such road as a paved street, no matter how or with what material it was paved. No such adoption as a paved street can be inferred from laying water pipes in the street, or lighting it or collecting garbage and ashes from houses on it, or requiring persons to take out a permit for making openings in it, or permitting the operation of an electric railway on it, or the paving of the center of the street with vitrified brick by the railway company.—City of Philadelphia v. Hafer, 38 Pa. Super. Ct. 382.

Use of Unbarricaded Street Not Contributory Negligence.—So long as streets remain unbarricaded and open to public use, there is an implied invitation for the use, and a person using them is not negligent unless he has knowledge of the dangers incident to the proper use thereof, and the mere knowledge of the general unsafe condition of such a street on the part of one using it with a right to do so would not render him negligent.—Scurlock v. City of Boone, 121 N. W. 369.

Buildings Upon Lands Leased from City Not Assessable for Taxation as Real Estate.—The buildings, equipments, etc., of a filter plant erected on land belonging to and leased from the city of Lancaster are not taxable for local purposes separate and apart from the land, as it is not real estate.—East Lampeter Township v. Maignen Filter Plant, Owner, etc., 26 L. L. R. 396.

Defect in Sidewalk—City's Liability for Resulting Injury.—A city is not liable for an injury from a defect in a sidewalk or street unless the defect was created by the city or with its knowledge, actual or constructive, and it was negligent in not repairing it within a reasonable time after it knew or should have known thereof.—City of Portsmouth v. Houseman (Supreme Ct. Va.)

Injury to Property Resulting from Change of Grade—Abutting and Non-abutting Owners—Damages.—Where a non-abutting owner claims damages by reason of a street improvement, the burden always rests upon him to show immediate and substantial injury occasioned thereby. As to non-abutting owners, there can be no claim for property actually taken, and the damages, if any, must be such as result from some consequential injury, which must be proximate, immediate and substantial.—Ogontz Avenue Case, 225 Pa. Supreme Ct. 129.

Municipal Regulation of Billboards on Private Property.—So long as billboards erected upon private property are secure against falling upon the passerby, so long as they entail no risk of fire within proper fire limits, so long as they do not smell bad, or spread disease, and so long as they do not offend the moral instincts of mayor and police, they enjoy absolute constitutional immunity. An ordinance based upon the grounds herein suggested is within the legitimate bounds of police regulation.—Galland v. City of Wilkes-Barre, Pa. Supreme Ct.

Stones Along Highway Frightening Horse—Not Negligence if Properly Located.—It is held that a city cannot be held liable for injuries due to the frightening of a horse by stones, which, for the purpose of repairing a highway, it had piled along the curb out of the traveled path, if it has used due care in their location, notwithstanding they are permitted to remain longer than is absolutely necessary before the injury occurs.—Elam v. Mt. Sterling (Ky.), 20 L. R. A. (N. S.) 512.

Dangerous Condition in Street—Reasonable Time to Remedy.—Whether such reasonable time has elapsed between the origin of a dangerous condition in a street and an injury to a traveler as to have enabled the city to have remedied such conditions, is for the jury. Defendants' failure to inspect the street for a week held not negligence as a matter of law.—Revis v. City of Raleigh (N. C.), 1909.

First Pavement Defined.—A "first pavement" in the legal sense, which exempts the abutting property owner from liability for any subsequent improvement, is one that is put down originally, or adopted or acquiesced in subsequently, by the municipal authority, for the purpose of changing an ordinary road into a street, and may be of macadam or anything else; but, if the purpose be wanting, a mere surfacing of the road will not be a paving.—City of Philadelphia v. Hafer, 38 Pa. Super. Ct. 382.

Roadbed of Railroad Not Subject to Assessment as Real Estate.—The roadbed of a public railroad is not "real estate" within the meaning of Act June 4, 1901 (P. L. 364), providing that "all real es-

tate * * * shall be subject to all tax claims and municipal claims herein provided for," and is not subject to assessment for laying a water pipe in a street on which the right of way abuts.—City of Philadelphia v. Philadelphia & R. R. Co., 38 Pa. Super Ct. 529, 531.

Departure from Specifications in Improvement Releases Abutting Owner from Obligation to Pay.—A lot owner is not bound to pay for a sidewalk built by the municipality, where the materials used were different from those specified in the resolution providing for the walk and the notice to abutting owners, and collection of the assessment for the improvement will be enjoined.—Meek v. Village of Collinwood, 30 Ohio Cir. Ct. R. 63.

Street Improvement Not in Accordance with Contract—When Property Owners Must Raise Objection.—The owner of property abutting on a street improved by the city cannot avoid an assessment against the property by showing that the improvement was not done in accordance with the contract, as that defense must be raised at the confirmation of the assessment, made at a hearing of which he had notice, as provided by law.—City of Woodlawn v. Durham (Ala.), 50 So. 356.

Assessments Must Be Grossly Excessive to Be Reduced by Court.—Assessments must be grossly excessive to warrant reduction by a court of equity.—King v. City of Dayton, 30 Ohio Cir. Ct. R. 480.

Sewer Assessment—District Deemed to Be Benefited.—If a main sewer is adequate and so located that it can be utilized in the future by the construction of convenient laterals, the lands in the whole district will be deemed specially benefited. It is not necessary that property be improved so as to make sewer connections immediately available.—Idem.

Ordinance Prohibiting Operation of Stone Quarry Invalid.—A city ordinance, prohibiting the maintaining or operating of a stone quarry within the city limits, is invalid as an attempt to prohibit rather than regulate a legitimate business.—Pacific States Supply Co. v. City and County of San Francisco (U. S. C. C., Cal.), 171 F. 727.

Unguarded Excavation Under Permit to Contractor—Owner of Property Liable for Injuries to Pedestrian.—Where a pedestrian on a public sidewalk falls into an excavation made for the purpose of making sewer connections with houses in course of construction, the owners of the houses are liable for the resulting damages, if the excavation was unguarded, and the permit issued to the contractor, and of which the owner had notice, required guards.—District of Columbia v. Blackman (D. C.), 32 App. D. C. 32.

Notice to City of Personal Injury Is Mandatory.—The statute (Rev. St., c. 70, secs. 7, 8, Ill.) requiring notice to a city of personal injury is mandatory, and the giving of the notice required is a condition precedent to the right to sue.—Smith v. City of Chicago Heights, 141 Ill. App. 588.

Damages to Residence Property by Proximity of Electric Power Plant.

The supreme court of Texas reversed the judgment of the lower court, December 15, in the case of the Sherman Gas and Electric Company vs. Maggie P. Belden et al. The lower court had given a judgment against the Sherman Gas and Electric Company, which the court of civil appeals had affirmed, the ground being that the defendant in the lower court had erected its plant on a lot adjoining the Belden home, the damage being sought by reason of inconveniences, noise and discomfort caused by the operation of the plant. The contention was made also that the value of the property for home purposes had been reduced as much as $1,250.

An opinion, declaring that any person is entitled to certain rights, and that many businesses may be carried on next door to a residence which may not be altogether pleasant to the inhabitants of the house, but for which the owner cannot necessarily recover damages, was rendered by Associate Judge Brown. He called attention to the fact that the trial court charged the jury that if the property had been damaged and the value diminished for the purpose for which plaintiffs were using it, by reason of the operation of the defendant's plant in the manner in which it was maintained, that they should find for the plaintiff.

He held that the company was responsible only for the injury caused by the operation of its plant, and that the judge should have defined in his charge a "nuisance," and submitted that issue with instructions that if it should find a nuisance to exist, they should find for the plaintiff compensation for the discomfort and inconvenience suffered. He held that the trial court eliminated this issue and gave the jury an incorrect standard for its guidance. Judge Brown also held that the trial court erred in instructing the jury to ascertain the value of the property for the purpose to which the plaintiff had dedicated it, just before the plant was built, and such value just after the construction and operation of the plant. The opinion recites that if the property would sell for as much for any purpose after the construction of the plant as before, there could be no recovery for its reduction in value as a home.

Iowa City Debt Limits 5 Per Cent. of Real Value.

A decision rendered by Judge Smith McPherson, October 23, in the Council Bluffs, Ia., water works case, holds that the 5 per cent. limitation of indebtedness placed on Iowa cities applies to the real property valuation, and not the assessed valuation.

The assessed valuation is only one-fourth of the actual value, so 5 per cent. of the assessed valuation would mean but 1.25 per cent. of the real. Judge McPherson says:

All provisions of a constitution are mandatory. There is no such thing as a directory provision in a constitution. All paragraphs, all sections, and all words must be given full force and meaning. With these things in mind, the provision must be analyzed. When that is done we shall see that the debts heretofore created, added to the now proposed debt, shall not exceed 5 per cent. of the property, because the constitution provides that a city shall not in any manner or for any purpose go in debt beyond that limit.

But 5 per cent. of what? And how is the 5 per cent. ascertained? The first question of 5 per cent. of what is answered by the wording of the constitution, which recites: "Five per centum on the value of the taxable property within such corporation (city)." The words "value of the taxable property of the taxpayers" are what are used. It is known that exemptions from taxation are made, such as court houses, poor farms, church property, hospitals, homesteads of soldiers, etc. Such property is not to be considered, because taxable property only is to be taken into account. Of such taxable property 5 per centum is to be ascertained. But what amount? The constitution says, "5 per centum on the value of the taxable property." So that it seems clear to me that we must take 5 per centum on the value of all the property to be taxed within the city.

But how ascertained is the more difficult? That is, how are we to arrive at the value of the taxable property? Values of property for this purpose cannot be ascertained by the courts hearing evidence. One witness will say that a house and lot are worth $5,000, and one witness a larger and another witness a smaller sum. We find that the constitution requires that such valuation shall "be ascertained by the last state and county tax lists." The tax list in the first instance is made by the township or city assessor. His valuation, as noted by him and returned to the county auditor, is binding, final and conclusive, subject only to what may be called appellate proceedings by the board of review (the city council), subject further to the county board equalizing as between precincts, and the state board as between counties. But the assessor's notations, in the end, modified or not modified, go into the hands of the auditor. He takes the figures thus returned and multiplies them by the tax levies, and his figures are certified to the treasurer for collection. Practically ever since we have been a state the law has required assessments to be made at the actual value of the property. But selfishness and greed to avoid taxation by individuals, and by assessors and boards of review to assist neighbors and political friends, has resulted in a valuation of from 30 to 40 per cent. of the true value. The result has been the same as if a true valuation had been ascertained, because the levy as a multiplier has been increased as the valuation was reduced. But this evil, real or supposed, was sought to be remedied by the legislature by enacting a statute presently to be noticed.

The valuation of the property of the taxpayers on which the 5 per centum is to be computed is to be "ascertained by the last state and county tax list." What is the tax list as defined by the constitution? Section 1305 of the code is as follows:

"Valuation. All property subject to taxation shall be valued at its actual value, which shall be entered opposite each item, and shall be assessed at 25 per cent. of such actual value. Such assessed value shall be entered in a separate column opposite each item, and is to be taken and considered as the taxable value at which it shall be listed and upon which the levy shall be made. Actual value of property as used in this chapter shall mean its value in the market in the ordinary course of trade."

Herein is the pivotal question in the case. And the statement thereof, first of all, presents the inquiry whether this statute has been construed by the supreme court of the state, and whether such construction has been held to be valid or void, under the provision of the Iowa constitution limiting the indebtedness of a city to 5 per centum.

The construction given state statutes and state constitutions by the highest court of a state will ordinarily be followed by United States courts. Particularly is this so when the facts and transactions of the case have arisen since the decision of the state supreme court was made.

Therefore, waiving my own views, and properly putting all arguments to one side, it is only necessary to call attention to what the state supreme court has decided, if such construction has been given with an affirmative holding upholding similar municipal action. With this in mind, and observing this rule, in my opinion the question is put at rest by the case of Halsey vs. City of Belle Plaine, 128 Iowa 467, decided in the year 1905, three years prior to any action taken in the matter under consideration by the city of Council Bluffs.

Water Rates in Utica, N. Y., in Litigation.

A decision has been rendered in the United States circuit court at Utica, N. Y., by Judge Ray, overruling the demurrer interposed by the Consolidated Water Company of Utica, in the case of Edwin H. Risley and others vs. the city of Utica, the Consolidated Water Company and others. When the suit was first instituted the water company objected on the ground that the plaintiff was not interested to an amount large enough to give him standing in court. The court granted Mr. Risley leave to amend his complaint by adding the names of some other taxpayers, and in other particulars. The water company interposed a demurrer to the amended complaint, alleging that the complaint was multifarious and irregular generally. It also asked to have the complaint dismissed and to have set aside a stay order which restrained the controller from paying over to the company the amount of its bills for the last two years, amounting to about $85,000.

In his decision in which he overruled the demurrer and denied the motion to dissolve the injunction, Judge Ray says, in part:

It would seem plain that much is demanded by way of relief that could not be granted, conceding all the allegations of the bill to be true, but a demurrer does not lie to the demand for relief. Nor

is it intended to indicate that all the matters charged, if true, are the subject of relief. What is decided is that on the whole bill a case is made of equitable cognizance and of which this court has jurisdiction, and that the bill is not open to the charge of multifariousness. Several questions have been raised and discussed which the court is not called upon to determine in advance of the final hearing. It will hardly be contended, I think, that the city of Utica, by its common council, had the right to go outside the city of Utica and make improvements and expend money or contract with some corporation so to do, for the benefit of outside localities as well as Utica. * * * There should be a speedy determination of this case on the merits, and if not at issue and tried at the December term, the motion to vacate or modify the injunction may be renewed.

The effect of the decision is to try the case on its merits, and this will mean a determination of the points raised against the water works contract for the last twenty-five years. The complaint alleges that the levy of taxes which contained items for water tax under the contract deprived property owners of their property without due process of law, in that there was no authority under the law for levying the tax. The water company, it is alleged, is a monopoly to control the price of water, and the rates to private consumers are about three times the prices charged in other cities.

The bill of complaint asks that the court fix the actual value of the water company's plant in Utica and apportion the amount to be paid between the private consumers of water and the city, and that the company's income from all sources be limited to 5 per cent. on the actual value of the water company's plant. The actual value of the plant, the bill alleges, does not exceed $1,600,000. It is set forth that the water company received, in the year preceding October 31, 1908, something over $267,000 from all sources, and that the actual value of the water furnished for fire protection purposes, if sold to a single person, would be approximately $1,000, at the rate charged for water for private purposes.

WATER AND ROADS

Prevention of Stream Pollution—New Jersey Water Conservation—Bituminous Macadam for New Jersey

Practical Methods of Prohibiting Stream Pollution in Use in Germany.

The manner in which German rivers are officially guarded from being polluted by pulp factories is described by Vice Consul W. Washington Brunswick, of Chemnitz, as follows:

The pulp manufacturers are required to use every precaution possible, so that not even a particle of the waste can reach the stream. The water which is to be emptied into the river must leave the factory in an absolutely clean condition, free from any remnants from the manufacturing process. This is accomplished by sending it through one or more settling ponds, and, if necessary, the waste must be passed through filters. The streams are regularly patroled by inspectors, and any justified claims against the quality of the waters, due to pollution from the factories, is at once investigated and must be dealt with immediately, regardless of the cost. There are no regulations setting forth the exact method which a manufacturer must employ to prevent the pollution of the streams; each manufacturer can use his own ideas upon the subject as long as his method fulfills the requirements. Settling ponds are invariably used, and the results are always satisfactory. An employe of the inspection bureau of factories, who makes tours from time to time to inspect the disposition of the waste material of the factories, is under the immediate jurisdiction of the county authorities, and has charge of the licenses to the factories and of the inspection. The law is enforced to the letter, and any violation, whether unintentional or not, compels the manufacturer to pay all costs in connection with removing the pollution from the streams. A manufacturer whose works are located on one of the small streams in Saxony polluted the water, and the inspectors compelled the owner to bear all the expenses for cleaning the stream and freeing it of impurities due to his negligence. The cost of freeing the stream from pollution used up the earnings of the factory for several years.

State Water Supply Commission Is Conserving New Jersey Waters.

The State Water Supply Commission of New Jersey refused, November 30, the application of the city of Paterson for permission to construct a reservoir near Midvale for the purpose of supplying the city with water from the Wanaque watershed.

The commission announced its intention of adhering to the policy of conserving all the water supply territory possible in anticipation of future needs, granting rights only where the demand is to supply an urgent and already existing need.

Bituminous Macadam Roads for New Jersey.

In the opinion of Col. Frederick Gilkyson, state road commissioner of New Jersey, macadam is unequal to the wear and tear of automobile traffic, and the state must change its methods of construction if its roads are to be kept up to date. State Commissioner Gilkyson has reached this decision after much inquiry and many experiments, which have demonstrated that pavements superior to the ordinary asphalt may be laid in cities and suburban districts at from $1.15 to $1.50 per square yard, where they now cost $1.90 to $2.50 per square yard. The pavement referred to is bituminous macadam. The state now has eighty-five miles of bituminous pavements, and specifications have been prepared for thirteen miles more. Colonel Gilkyson is acting in connection with the federal authorities at Washington to bring about the formation of a paving commission to supervise this method of road building, thus avoiding conflicts with any of the patented compounds. In this way open bidding will be possible and the cost will be lessened.

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports—Washington Water—Philippine Journal

Municipal Reports.

Forty-fourth Annual Report of the Board of Water Commissioners of Reading, Pa. 1907-8. Emil A. Nuebling, Superintendent and Engineer.

Progress was made on the construction of the filter plant on the portion of the supply drawn from Maiden Creek. Meantime a typhoid fever epidemic occurred, which was traced to this supply, and the water was treated for some time with copper sulphate at the rate of 1 part to 1,200,000 parts of water, which was reduced to one-third the quantity in January. A chemical and bacteriological laboratory was fitted up during the same month and some experiments on the value of hypochlorite of lime as a germicide were made. The first tests showed but little more result was obtained for any increase in quantities of the hypochlorite above one-sixteenth of a grain per gallon, and that the use of one-quarter grain per gallon on Maiden Creek water would produce the same percentage of removal of harmful bacteria as a good filter, viz., 85 to 90 per cent., and that application of materially larger quantities can be detected by the odor in the water.

The cost of cleaning the filters in use was reduced materially by improving the methods of cleaning and handling the sand.

The standard form of summary of statistics is used and the detailed tables of statistics, and of cost of operations, are more than usually satisfactory.

Nineteenth Semi-Annual Report of the Sewerage and Water Board of New Orleans, La. June 30, 1909. Geo. G. Earl, General Superintendent.

The board worked under great disadvantages during the half year covered by this report, for an attempt to sell $4,000,000 in bonds failed, and the board was required to keep its expenditures within $1,000,000, which was raised, and the special taxes, etc., amounting to about $380,000 additional. The expenditures for the half year were actually $1,301,938.62. Thus far the construction of the sewerage system has cost $4,485,412.63; the water works, $6,895,755.64, and the drainage system, $4,668,390.70. The expenses of carrying the work on have been $441,755.31 for the sewerage system, $268,825.47 for water works, $229,352.26 for drainage and $394,357.96 general purposes, and the interest paid on bonds has amounted to $1,471,410.69, so that the total cost to the city thus far has been $20,631,782.42. Bonds to the amount of $13,000,000 have been issued, for which net premiums of $494,280 were received, although the last million was sold at a discount of $60,000.

About nine miles of sewers were laid during the six months and one and three-quarter miles of water pipe. The new filter plant was put in operation February 9, 1909. About thirty-one miles of subsurface drainage lines were laid during the period of the report.

Annual Report of the City Engineer of Salt Lake City, Utah. 1908. Louis C. Kelsey, City Engineer during the year. Geo. O. Chaney, Prin. Asst. Engr., now City Engineer.

This report is one of the most extensive and most thoroughly detailed which is issued. Information taken from it will be published from time to time. Attention may be called here to some of the special features shown by the report.

One of these is the system of classification of records and accounts, whereby all the documents and references to each class of work receive the same number. Items under the contingent fund are numbered from 1 to 20, such as 2 for resurvey, 7 for health department, 13 for board of

public works, 18 for law department; water supply items are numbered from 21 to 30, water works 31 to 35, streets and sidewalks 36 to 45, sewers and drains 46 to 50. Each number has its subdivisions. Thus 2A refers to preliminary surveys, 2B to locating and setting monuments, etc.; the law department runs over the alphabet, so that case 18A3 is Foosberg versus the city, 18B3 is Wm. L. Bells versus the city, 18D3 is N. Jordan Irrigation Co. et al. versus S. Jordan Canal Co. et al., etc.; also such headings as paving, sewer, water main extensions, run by numbers instead of letters, water main extension No. 227, for example, being known as 35—227. All accounts, records, note books, maps, plats, etc., bear the same numbers, so that all can be easily gathered together when necessary.

Accompanying the classification is a new system of fire-proof filing cases in a fire-proof vault of large size, which classifies the records as correspondence; loose leaf notes from field and office, all notes being kept thus, as described in a special article in MUNICIPAL ENGINEERING, vol. xxx, p. 409; field books; drawings; photographic negatives. The records for current matters are kept in a current file, and as the file fills up and the matters pass out of immediate view, the records are moved to the permanent files, bound in pasteboard pamphlet binders and labeled. Vertical files and drawers are used according to the convenience of filing. The magnitude of the file is shown by the statement that there were on file at the beginning of this year 1,000 folders, 1,629 field books, 4,183 drawings, of which 3,125 are tracings and 1,873 photographic negatives. The characteristics of the system, which the writer had the opportunity to examine last summer, are simplicity, immediate reference and expansibility.

The city is involved in a number of suits over its various systems of water supply for domestic purposes, irrigation, and exchange, and a large part of the report is filled with detailed results of observations of rainfall, flow of water, pumpage, etc., so that the city will know at all times exactly what its water supply is and whence it comes.

Contract work in 1908 amounted to $871,704.95, as compared with $1,207,160.48 in 1907, the heaviest year the city has ever had. The proportion of the engineering expense belonging to this work amounted to 3.24 per cent. of the contract price in 1908, as compared with 2.65 per cent. in 1907, 3.45 per cent. in 1906 and 8.85 per cent. in 1905.

A Philippine Scientific Journal.

The *Philippine Journal of Science*, published at Manila, P. I., is devoted to the scientific and commercial interests of the tropics. It is published in three sections, general science ($2 a year), medical science ($3) and botany ($2), or the entire journal ($5), and seems to be issued quarterly.

Proposed Improvements of Water Supply of Washington, D. C.

The installation of a system of meters for all public and private services, and the construction of a modern coagulating plant in conjunction with the Georgetown reservoir, is advocated by Major J. J. Morrow, engineer officer in direct charge of the water service of the District of Columbia.

As a result of his preliminary investigations and surveys for increasing the water supply of the District, Major Morrow reached the following conclusions:

First—The efforts of the water department of the District of Columbia of the last three years, looking to a suppression of waste, have produced such remarkable results as to imperatively demand their continuance and extension by rapidly covering all services, both private and public, in the District of Columbia, by meters.

Second—As an alternative to providing for the construction of an additional storage reservoir, which will become more necessary as the demand for water increases, and to provide for the more efficient working of the present filtration plant during periods of excessive turbidity in Potomac water, the construction of a coagulating plant and remodeling of Georgetown reservoir for use in connection therewith is imperatively demanded as a necessary adjunct to the present system and should be at once begun.

Third—Contingent upon the adoption of these measures there can be no doubt that the consumption and waste of water in the District of Columbia in the next few years will be far enough below the safe working capacity of the existing aqueduct to make it safe to postpone new construction until fuller and more definite results are at hand to predict accurately the date at which such construction must be completed.

Fourth—There appears to be no justification for an increase in the supply through fear of failure in any of the structures of the existing system.

Fifth—When the necessity arises for an increase in the supply there appear to be three projects, any of which would give a satisfactory supply at least as great as the present, and at reasonable cost. From Great Falls an aqueduct, with all necessary appurtenant structures, could be constructed with such slight variations from plans which have been worked out in considerable detail as might be deemed necessary by advances in the art of providing public water supplies, at a cost of $3,900,000, and the work could be done in from four to five years' time, of which at least a year would be consumed in the necessary work of acquisition of title to lands necessary. On another route from Great Falls, withdrawn from the line of the existing aqueduct as far as topography will permit, an aqueduct with all appurtenant structures could be constructed at a cost of $4,350,000, and in about the same length of time.

From the Patuxent valley an aqueduct with all necessary appurtenant structures

could be constructed in from four to six years' time. Sufficient data as to cost of this development are not, however, at hand, and a known additional obstacle appears to its adoption, as the power to enter the state of Maryland for this purpose must first be obtained from that state. The project, however, offers known advantages which would justify its adoption as against the Great Falls project, even at an increased cost of nearly $1,000,000. These advantages justify a careful study at an early date, for which the sum of $3,000 should be appropriated.

Sixth—Contingent upon the construction of the coagulating plant recommended, no additional storage capacity need be provided, even when the additional conduit is constructed, nor will any addition be required to the present filtration plant beyond slight modifications in the arrangement of ducts, even with a demand for twice the present maximum consumption.

Seventh—For reasons outlined in the report of Mr. Hazen, the officials of the District of Columbia should make arrangement to cover the present filtered water reservoirs at Reno and Brightwood at as early a date as will be permitted by funds at their disposal.

ORGANIZATIONS AND INDIVIDUALS

Indiana Engineering Society—Technical Meetings—Technical Schools—Civil Service—Personal Notes

Convention of Indiana Engineering Society.

The program for the Indiana Engineering Society meeting, January 13 to 15, 1910, to be held at the Denison Hotel, Indianapolis, includes the president's address, by E. E. Watts, of Princeton; papers upon subjects pertinent to stream pollution, by Chas. C. Brown, Prof. R. L. Sackett and H. C. Jordan; illustrated paper by Prof. Malverd A. Howe, of Terre Haute, entitled "Arches: a Historic Sketch;" "Some Types of Reinforced Construction," by E. E. Watts; "Preparation of Plans for Steel Highway Bridges," by B. B. Johnson; "The Ohio River Sanitary Commission," by Hon. W. J. Wood; "The Work of the Indiana Railroad Commission," by Hon. W. J. Wood; "Deep Well System of South Bend, Ind.," by A. J. Hammond, city engineer; "A Sewer Franchise," by J. W. Fulwider; "A Proposed Telephone Franchise," by Charles Carroll Brown.

There will also be papers, titles not yet announced, by Prof. W. K. Hatt, Chas. Brossmann and C. L. Olds, and reports of committees in all the different branches of the society.

The annual banquet will be held on the 13th, at 7:30 p. m.

A prominent feature of the convention will be exhibits of articles, devices and products of interest to engineers and those connected with engineering works in rooms and corridors adjacent to the convention hall. Charles Brossmann is secretary, 43 Union Trust Building, Indianapolis, Ind.

Technical Meetings.

The American Association for International conciliation will send to members of boards of trade copies of a paper by John Ball Osborne, of the U. S. Departpartment of State, bureau of trade relations, on "The Influence of Commerce on the Promotion of International Peace."

The officers of the American Brotherhood of Cement Workers of America are F. C. Gengenbeck, president, Chicago; Henry Ullner, secretary and treasurer, San Francisco, Cal., and vice presidents from New York, Chicago, San Francisco and St. Louis.

The Illinois Association of Municipal Contractors proposes to improve the quality, quantity and efficiency of public improvements, and as a means to that end suggests to boards of local improvements early starting of the legal proceedings so that the work can be let during the winter and construction can begin early in the spring. William Howe is the executive secretary and his office is at 805 Atwood Bldg., Chicago, Ill.

The Museum of Safety and Sanitation, 29 W. 39th St., New York, has a lecture committee which is arranging a schedule of lectures for the winter which will be delivered where they are wanted if meeting place, local publicity and lantern expenses are guaranteed.

The Brooklyn Engineers' Club held its annual meeting and dinner on December 9. The officers elected were Geo. A. Orrok, president, Joseph Strachan, secretary, Wm. T. Donnelly, treasurer.

The National Association of Cement Users is making a campaign for new members and offers much of value in return for the annual dues of $5. Some of its committees are working hard upon their reports for the next convention, to be

held in Chicago, February 21-25. The committee on specifications for cement products is looking for suggestions regarding standard specifications for cement brick, tile, pipe, finish for buildings, manufactured stone and for information about thickness of joints, coloring, cement products, and defects in the adopted specifications for cement blocks. The committee on exterior treatment of concrete surfaces is also on the search for information about a larger number of details of material and workmanship on surface, methods of removal of surface and of coating surfaces, possibilities and limitations of surface in ornamental work, waterproofing, effects of blemishes and remedies therefor, specifications and costs. The list of points alone is an education in the subject.

The seventh annual dinner of the Municipal Engineers of the City of New York was held December 11 at the Hotel Savoy. At the meeting December 22 Francis L. Pruyn presented a paper on "The Reduction of the Water Table and Its Effect on Foundations in New York City."

The prizes for the ornamental centerpiece to be erected at the Chicago cement show have been awarded. The first goes to Wilbur Karl Howenstein, of Chicago, the second to Ernest V. Price, of Spokane, Wash., and the third to George Aswumb, of Chicago. The successful design is composed of a great pedestal supporting a shaft 30 feet high, which in turn supports a figure of heroic size. The four sides of the pedestal have four figures in relief representing the stone, bronze, iron and cement ages. A few spaces on the second floor only are open for new exhibitors. Those coming to the show or to any of the conventions meeting at the same time, February 18-26, should obtain certificates from the ticket agents from whom they purchase their tickets, which will entitle them to return tickets at half fare.

In addition to the business meeting, the annual meeting of the American Society of Civil Engineers will include an inspection of the works of the Pennsylvania tunnel and terminal railroad, the president's reception, another visit to the Ashokan reservoir of the new New York water supply now under construction in the Catskill mountains, an illustrated address on conservation of New York's water resources by Walter McCulloh, consulting engineer of the State Water Supply Commissioner, and an informal smoker on January 19 and 20. Charles Warren Hunt is secretary, 220 W. 57th street, New York.

The first monthly meeting of the American Society of Engineering Contractors was held in New York December 14. An Address on "The Science of Management Engineering" was delivered by H. P. Gillette. The first local section of the society will be established in Indianapolis, Ind., under a recent action of the board of directors.

The annual meeting of the Wood Preservers Association will be held in Chicago, Ill., at the Auditorium Hotel, Jan. 18, 19 and 20. Walter Buchler, St. Louis, Mo., president.

The tenth annual convention of the National Good Roads Association was held at Topeka, Kas., Dec. 14 and 15. A resolution was adopted urging the use of both convicts and enlisted men of the army in the construction of good roads; urging the construction by the national government of a system of highways connecting Washington with every state capital; endorsing the plan for a military road from Fort Leavenworth to Fort Riley; calling upon the national government to adopt a fixed policy and to make appropriations for permanent road work; urging state laws compelling the payment of poll tax in cash and providing that all moneys collected by the states from "licensing of electric, gasoline and steam driven pleasure and commercial vehicles be set aside for the improvement of state highways."

The annual meeting of the Montana Society of Engineers will be held at Butte, Mont., Jan. 6, 7 and 8. Clinton H. Moore, secretary, Butte.

The annual meeting of the Michigan Engineering Society will be held at Lansing, Mich., Jan. 12, 13 and 14. Alba L. Holmes, secretary, 574 Wealthy avenue, Grand Rapids, Mich.

The annual meeting of the Canadian Society of Civil Engineers will be held at Ottawa, Ont., Jan. 25, 26 and 27. C. H. McLeod, secretary, 413 Dorchester street, West Montreal, Que.

The convention of the Illinois Society of Engineers and Surveyors will be held at Cairo, Ill., Jan. 26, 27 and 28. E. E. R. Tratman, secretary, 1636 Monadnock Blk., Chicago.

The annual convention of the National Brick Manufacturers' Association will be held at Pittsburg, Pa., Feb. 7, 8, 9, 10, 11 and 12. T. A. Randall, secretary, Indianapolis, Ind.

The annual convention of the Connecticut Society of Civil Engineers will be held at New Haven, Conn., Feb. 8. J. Frederick Jackson, secretary, Box 1304, New Haven, Conn.

The annual meeting of the New England Association of Gas Engineers will be held at Boston, Mass., Feb. 16. N. W. Gifford, secretary, 26 Central Square, E. Boston, Mass.

The annual convention of the Iowa Engineering Society will be held at Cedar Rapids, Ia., Feb. 16 and 17. A. H. Ford, secretary, Iowa City, Ia.

The Technical Schools.

The State University of Iowa publishes the monthly, *Iowa Alumnus*.

The president's report of Cornell University with the subsidiary reports and appendices covers nearly 300 pages.

Civil Service Examinations.

The U. S. Civil Service Commission will hold civil service examinations at the usual places as follows:

Jan. 5, 6, 7: Senior draftsman in Ordnance Bureau, Washington, D. C., at $1,600 to $1,800 a year.

Jan. 12: Engineer-physicist, at $3,000 a year or associate engineer-physicist at $2,000 a year in the Bureau of Standards.

Jan. 19: Engineers in wood preservation at $1,000 and $1,300 a year in Forest Service in District No. 2, Denver, Colo.

Personal Notes.

David Barr, former mayor of Sarnia, Ontario, died in that city December 4, following a stroke of paralysis.

Dr. Ryota Hara, chief engineer of the city of Yokohoma, Japan, is visiting American cities to study their public works.

The Power Specialty Company announces the removal of its Boston office to 1031 State Mutual Building, 50 Congress street.

Anderson Polk, 32 W. 40th street, New York, is now in the railway department of the Lowe Brothers Company, paint makers at Dayton, O.

Mayor-elect Duryee, of Schenectady, N. Y., has announced his intention of appointing J. Leland Fitzgerald city engineer of that city. Mr. Fitzgerald has held the office a number of times.

William F. Morse, consulting sanitary engineer, whose specialty is the collection, treatment and disposal of municipal wastes, has opened offices in the Trinity building, 111 Broadway, New York.

E. R. Stapleton, long so favorably known in the western cement trade, is now the general sales agent of the Western States Portland Cement Co., with offices at 218 N. Y. Life building, Kansas City, Mo.

Dr. James D. McDowell, mayor-elect of Vincennes, Ind., has appointed William P. Ritterskamp a member of the board of public works; reappointed Joseph V. Hershey, city engineer; George Fendrick, chief of fire department.

James Lemon, M. Inst. C. E., has been recently knighted by King Edward VII. of England. Mr. Lemon has been prominent in the designing and construction of the public improvement work in London during his service in the various official positions he has held since entering that field many years ago.

Senor Lucas Fernandez, chief engineer for the government of Costa Rica and engineer for the municipality of San Jose, is visiting this country inspecting sewerage systems in the larger cities. Senor Fernandez is spending some time in Houston, Texas, with relatives and to attend to a number of private matters.

Mayors have been elected in Massachusetts cities and towns as follows: Holyoke, Nathan P. Avery, sixth term; Worcester, James Logan, re-elected; Chicopee, Samuel F. Fletcher; Everett, Charles Bruce, re-elected; Lynn, James R. Rich, re-elected; Melrose, Eugene H. Moore, re-elected; Newburyport, Robert E. Burke; Newton, Charles E. Hatfield, re-elected; Somerville, John M. Woods, re-elected; Woburn, Hugh D. Murray.

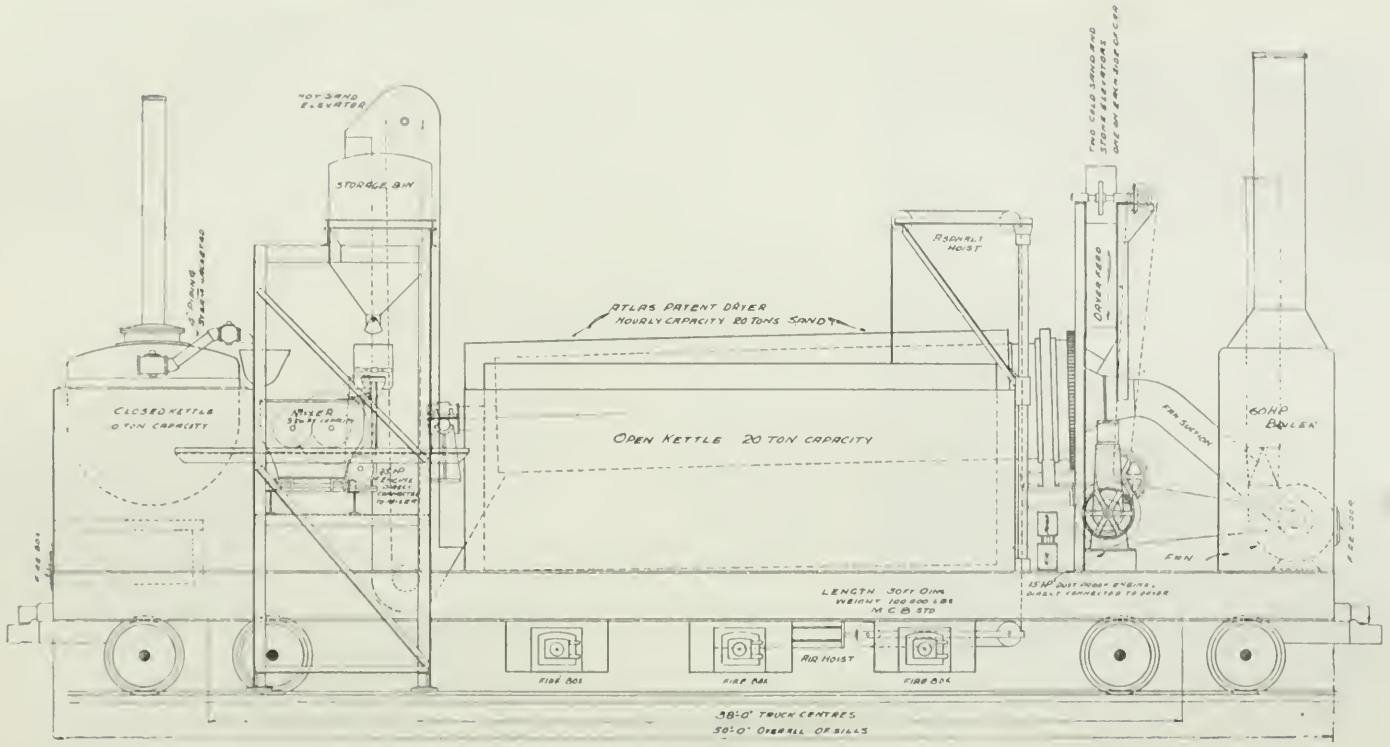
Daniel W. Church, chief assistant city engineer of Chicago, Ill., died in that city December 7. Mr. Church was first associated with the city engineer's office in Chicago in 1893, but resigned in about 18 months to take a position with the Pittsburg Bridge Company. He again rejoined the Chicago city engineering department in 1903 and served as chief assistant engineer up to the time of his death. Mr. Church was taken to the home of his family in Gouverneur, N. Y., for burial.

MACHINERY AND TRADE

Atlas Dryers and Portable Asphalt Plant.

The Atlas one-car portable asphalt paving plant has a guaranteed capacity of 1,800 yards of 2-inch topping and 4,000 yards of 1-inch binder per day of ten hours. The extreme overall length of the plant is but 50 feet and the weight less than 100,000 lbs., thus being the largest, yet smallest, and the lightest plant on the market. It can be surely called a "vest-pocket edition" of a railroad asphalt paving plant. The plant itself is up to date in every particular and strictly Atlas. It has one closed asphalt kettle, ten ton capacity, and one open asphalt melting kettle, twenty tons capacity, equipped for air agitation. Air is used for transferring asphalt from the open to the closed kettle, and from the closed kettle to the asphalt measuring bucket. There is also an air hoist for elevating asphalt to the open kettle. Westinghouse air compressor is used.

The dryer is direct driven by a self-contained, dust proof, 15 h. p. engine. The mixer, which is nine cubic feet capacity, steam jacketed, Iroquois make, is driven by direct connected 25 h. p. engine, same type as used for dryer. The boiler is 60 h. p. vertical type. There are two elevators at the feed end of the dryer—one for stone and one for sand, and a hot-sand elevator at the discharge end of the dryer for elevating the material up to the storage bin. The bin has capacity of four cubic yards of sand. The hot-sand elevator is driven from the engine, which drives the



THE ATLAS ONE-CAR PORTABLE ASHALT PAVING PLANT.

mixer, and the two cold-sand elevators and the fan are driven from the engine which drives the dryer.

The Atlas dryer on the plant makes it possible to produce such a big little plant that will deliver the product.

The sand is screened by a screen on the back end of the dryer cylinder. The screen is pushed to one side when binder is run.

The plant can be run with five ordinary laborers and one handy man, who should be a steam engineer.

An Atlas dryer can be put on any type of plant. It will double the drying capacity and not use any more space than the dryer, or dryers, it replaces. Atlas dryers dry nearly everything.

Large Vitrified Sewer Pipe.

The Blackmer & Post Pipe Co., St. Louis, Mo., issue a booklet on vitrified pipe sewers which contains some valuable information. This company has been the pioneer in large sizes of vitrified pipe and has gradually increased the maximum size from 30 to 33 and 36 inches diameter, and now undertakes the manufacture of 42-inch pipe. The demand for these large sizes has increased until the additional buildings and grounds provided in 1900 for their manufacture have become too small and enlargements are now in progress.

The only thing in the way of general use of these large sizes is the greater first cost of sewers laid with them. The pamphlet makes a very strong argument on the better value of the vitrified pipe sewer, in that it is cleaner, more durable, will not absorb or retain offensive matter, is more convenient in construction, can be laid with unskilled labor, and has less frictional resistance, so that pipes one-fifth smaller can be used, because of the greater capacity.

There is a financial argument, showing the amount which the first cost of a pipe of continuous life can exceed the first cost of pipes or sewers of certain definite lengths of life and still be equal in cost in the long run. Thus a pipe which requires no replacement can cost twice as much for first construction as one which requires replacement every 20 years. Copies of the pamphlet, giving numerous other arguments also, will be sent on application to the company.

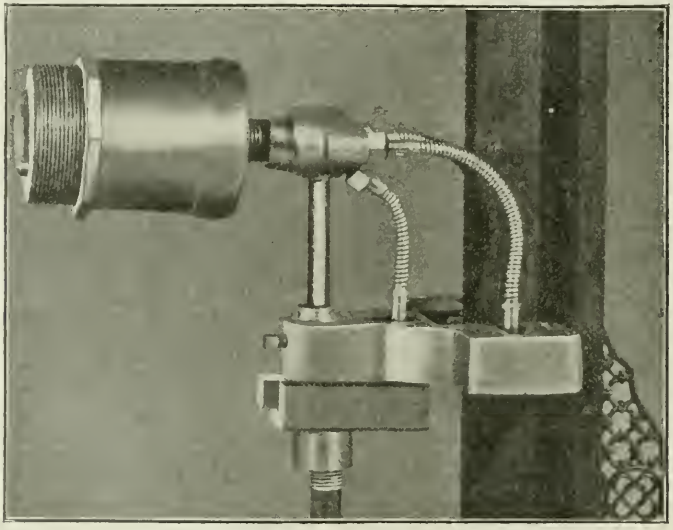
Lubricator for Elevator Guides.

The accompanying photograph shows the Imperial elevator-guide lubricator, the use of which insures a constant and automatic lubrication of elevator guides and stops the slushing of guides by hand with its loss of time and danger of accident to engineers or their assistants. Full information about the apparatus will be sent by the American Engineering and Manufacturing Company, 1215 Filbert street, Philadelphia, Pa.

Liquid Asphalt for Macadam Roads.

The Indian Refining Company, of Cincinnati, Ohio, makes two brands of liquid asphalt for use on roads, which they are putting on the market through their road preserving department. Their refineries are located at Georgetown, Ky; Lawrenceville and East St. Louis, Ill., not far from the sources from which they secure the materials.

One brand is called the 65 per cent.



IMPERIAL ELEVATOR-GUIDE LUBRICATOR.

grade, and is intended for cold surface treatment of roads already constructed. It is the outcome of several years of experience in the treating of roads. During these years, the one object of the road experts and chemists who had this work in charge, was to get material which, when applied cold to a macadam or gravel road, would penetrate into the road, bond the stone, give a smooth, dustless, mudless and resilient surface, last long enough to more than pay for itself and not pick up under traffic, injuring vehicles and clothes. Liquid asphalt is the result. In forty-eight hours of dry warm weather liquid asphalt will give these results and the road will be ready for traffic. Or, if a light coating of screenings, sharp sand or gravel is applied, about ten hours after the treatment, a still better result is obtained, and the road can be opened immediately to traffic. This treatment has lasted and is guaranteed to last for the dry season of the year in which the application is made and in a majority of cases, in the past, the road has been in a perfect condition for a much longer period of time.

The second brand is liquid asphalt binder, which contains 95 per cent. of bitumen. It is intended for new construction of bituminous macadam roads.

The company will send full information about both grades upon request.

Garbage Cremation.

Of all the methods of destroying garbage and refuse, that by fire is by far the most effective, as thus all accompanying bacteria are killed and the organic matter is completely oxidized into gases and only ashes are left behind. The destruction of garbage, or what is more correct, its reduction to ashes, in crematories, especially built for this purpose, is therefore now in almost universal use.

The design of a furnace for the burning of garbage, street sweepings, rubbish, etc., is, however, by far more difficult as it appears to one unacquainted with the problem. This is due to the ever changing composition of the materials to be destroyed and to the difficulty of securing complete combustion. Garbage, street sweepings, etc., contain a great amount of moisture, often from 30 to 72 per cent., which must be evaporated either in the process of burning or by preliminary drying, and a very high temperature and an excess of air must be maintained in the furnace at all times, as otherwise the chimney gases will be extremely offensive.

There have been put into service a number of different furnaces, most of them successful only in larger cities where the kinds of refuse are collected separately and where continuous operation can be maintained. Most of these large crematories need auxiliary fuel and with some of them a special apparatus for preliminary drying of the refuse had to be connected. Both cost of construction and cost of operation, have been very high and even for larger cities of 100,000 inhabitants and over, a garbage crematory plant up to this time has been a heavy burden. There was no furnace which met the demands of smaller cities and although the necessity of a crematory has been felt everywhere, even in the smallest country towns, the city authorities were unable to install such plant on account of its excessive cost.

The Thompson Garbage Crematory has been especially invented and designed to meet the demands of such communities, where all public improvements have to be done with utmost economy, and where the question of utilizing the waste heat in the crematory furnace for generating of steam for power plants does not arise.

The Thompson crematory is not designed to utilize the waste heat for steam generation on a large scale. The crematory is, however, provided with a water-tube grate, in which sufficient steam can be produced for driving a blower to increase the draft, if such should become necessary for certain purposes. In all ordinary cases, however, where mixed refuse is burned, natural draft alone is used, no blower or other machinery is attached, and therefore the Thompson crematory is a model of simplicity and economy.

In 1906 Mr. Jas. A. Thompson, then commissioner in charge of the water, sewerage and health department of the city of Houston, Tex., designed and installed his first crematory plant for the city of Houston, Tex., which has now been in successful operation for over three years.

This crematory is located in the center of a well built up section of the city, and has done its work without any objectionable effect. For over three years this crematory was the only method that the city of Houston used in destroying its garbage, refuse, the smaller dead animals, etc.

This plant has a capacity of about 65 cubic yards, and is sufficiently large to care for all the garbage removed from the business center of the city. No fuel is necessary for the furnace, as the lighter material is made to serve as fuel to consume the heavier substances. The smaller animals dying in the city limits are cremated here, and last summer the 563 dogs destroyed by the dog catcher were disposed of in this manner.

As a consequence of the excellent results obtained the city of Houston has now decided to replace this plant by a new Thompson crematory of a larger capacity.

In the winter of 1908-9 a Thompson crematory was built for the city of Austin, Tex., which has now been in use for some time with most satisfactory results.

Hendricks' Directory.

The eighteenth annual edition of Hendricks' Commercial Register of the United

States for Buyers and Sellers, has just been issued. It contains over 350,000 names and addresses of American manufacturers classified under 35,774 classifications, representing about every machine, material, apparatus or specialty required in the architectural engineering, mechanical, electrical, manufacturing, railroad, mine, quarrying and kindred industries, embracing everything for railroads, mines, building and construction, electrical trade, machine shops, foundries, contractors from a pick or shovel to a hoisting engine or steam shovel, agriculture, power transmission from a belt fastener to a complete system, including the latest specialties in right angle transmission and variable speed countershafts, heating and ventilating from an air valve or ventilating fan to a high or low pressure boiler, plumbing work, mill or factory, the drafting room from a drawing pencil to a blue printing machine, water supply from a water pressure gauge to a pumping engine or standpipe, municipal work from a paving brick or sewer inlet to a steam road roller, hardware, iron, steel and other metals, machinery, over 2,700 classifications of as many different kinds. S. E. Hendricks Co. are the publishers, 74 Lafayette street, New York City, and the price is $10.

How to Clean Deep Wells.

In the operation of deep wells for municipal, manufacturing or private use, a great deal of trouble, annoyance and expense is invariably encountered by the choking up of the well strainers, and loss of efficiency caused by the pumping of large quantities of air drawn through the open top of well and passing down into pump chamber.

The Clark well construction obviates these troubles and brings with it satisfaction and increased well capacity at greatly reduced cost; eliminating dangers of contamination, as surface waters, foul air and other impurities are prevented from entering well. This well construction is adapted for use on any kind of a well, and in connection with any kind of pumping head, direct steam power, geared or belted, or hand power.

The entire top of well is hermetically sealed, thus permitting by the operation of pump the formation of a vacuum extending to the bottom of the well and greatly increasing the draft or suction on the water bearing stratum. The vacuum formed is indicated on a vacuum gage.

By this equipment the capacity of wells has in some instances been increased 100 per cent., affording double the quantity of water, of greatly improved quality.

The vacuum gage forms a reliable and convenient tell-tale of the condition and efficiency of the pump at all times; as, knowing what the vacuum point should be under different conditions, a lowering therefrom is conclusive evidence of worn or leaky pump valves or packings.

On the discharge line from the pump there is placed a check valve and a pressure indicating gage. The discharge line is cross-connected onto the outside casing of the well.

By the operation of a gate valve a flow of water under pressure may be turned into the well casing and forced through the slots of the strainer at the bottom of the well, thus thoroughly forcing accumulated fine sand away from and thoroughly cleaning the strainer.

A pipe connection with small stop cock is placed at the extreme bottom of cleaning pipe, for the purpose of determining at any and all times whether there is a leakage of water past the gate valve.

Another pipe line connection is made on the cleaning line for the introduction of compressed air or steam under heavy pressure into well casing for cleaning purposes, where it is desired to so do.

This well construction is supplied by the H. W. Clark Co., Mattoon, Ill., the manufacturers of the well-known Clark meter box.

Trade Publications.

The H. W. Johns-Manville Co. publishes a brief illustrated description of "How 4 Cars of Coal Did the Work of 5."

The Christmas greeting of the H. Mueller Mfg. Co., Decatur, Ill., is deserving of special mention because it steps out of the line of trade and impresses upon the receiver a feeling of personal interest which is very grateful.

A preliminary discussion on creosoted wood block pavement by C. Marshall Taylor, in charge of the department of chemistry and tests, is issued in pamphlet form by the International Creosoting and Construction Co., which compares the specifications for blocks and oil now in use and presents the specifications used by this company.

The Universal Portland Cement Company's circular No. 67 has many photographs of ornamental and useful applications of cement in construction.

The Indianapolis office of the Lehigh Portland Cement Co. publishes a booklet on "The Modern Farmer," which shows many structures for farm use, made of cement, and tells how to make many of them. F. E. Paulson is the moving spirit in this office.

The Weber-Duller Co., 329 Commercial Bank Bldg., Houston, Tex., issue a booklet on "Economical Garbage Disposal and the Thompson Garbage Crematory."

A circular concerning the American Exposition to be held in Berlin, Germany, in June, July and August, 1910, has been received from the American Headquarters, 50 Church street, New York City.

The Power Specialty Co., 111 Broadway, New York, issue a handsomely illustrated catalog of the Foster patent superheater, showing it in all its details and giving photographs of many kinds of installations

with all sort of boilers and furnaces. It is one of the most satisfactory booklets of its kind because it is so complete and detailed and at the same time so brief.

Calendars, wall and desk reminders have been received from the following: Deckmann-Duty Brick Co., Cleveland, Collinwood, Carrollton, and Malvern, O.; Universal Portland Cement Co., Chicago, Ill., and Pittsburg, Pa.; the Springfield Republican, Springfield, Mass.

A. S. Aloe Co.'s catalog of mathematical and engineering instruments and drawing materials has been received from St. Louis, Mo.

Trade Notes.

ASPHALT.

Pittsburg, Pa.—Press reports of Dec. 13 state that as soon as plans have been prepared for the proposed new asphalt plant, the city will take possession of the Peabody site in Homewood, for the acquisition of which condemnation proceedings have been entered.

The Atlas Dryer Company, of Cleveland, Ohio, has just received an order from The Newell Quarry Company, of Cleveland, Ohio, for one of its Atlas dryers, self-contained type, with Atlas mechanical stoker, for burning slack bituminous coal, the dryer to be used for drying silica sand, capacity 150 tons per day of ten hours.

The Atlas Dryer Company, Cleveland, Ohio, reports that it has just shipped one of its Atlas dryers, self-contained type and completely erected, to the Metropolitan Construction Company, Wichita, Kan. The dryer is to replace a dryer of another make, that did not have sufficient capacity, on a portable asphalt paving plant. The first order from the Metropolitan Construction Company was for an Atlas one-car portable asphalt paving plant.

Fort Smith, Ark.—The Fort Smith Vitrified Brick Co. has been awarded a contract for supplying the Prairie Oil & Gas Co. with 1,000,000 brick for use in building pipe lines and pumping stations at Kinta, Okla., and DeQueen, Ark.

The Corry Brick and Tile Co., Corry, Pa., has installed one of Frank B. Dunn's machines for wire cutting lug brick, and reports that it works to perfection. The invention only needs to become well known to induce the general use of paving brick made in this manner without repressing.

BRICK.

Spokane, Wash.—Contracts will be let soon for constructing a steel and concrete plant for the People's Portland Cement Company, recently incorporated, at Squaw Bay on Lake Pend d'Oreille, 60 mis. northeast of Spokane. Arthur S. Ford, of New York City, and H. A. Groth, of Chicago, are interested in the proposed letting of the contracts.

Wayland, N. Y.—The Wayland Portland Cement Co. has purchased the cement works of the Thomas Millen Company, of Syracuse, N. Y., which has been operated in this city for the last 16 years. The Wayland Portland Cement Co. was organized by local business men, consisting of John Kimmel, F. K. Smith, F. C. Lander, H. V. Pratt and O. F. Kiefer, with officers as follows: President, John Kemmel; vice-president, F. K. Smith; treasurer, F. C. Lander; secretary and treasurer, O. F. Kiefer.

Rockland, Me.—The New England Portland Cement Co. contemplates the erection of cement manufacturing plant during 1910.

Evansville, Pa.—The Allentown Portland Cement Co. is erecting a plant here.

CONCRETE BLOCKS.

Hayden, Colo.—The Hayden Concrete Co. has been incorporated by David Flitner, T. Shelton and John E. Miles.

Jersey City, N. J.—The Marshall Concrete Construction Co. has been incorporated to manufacture concrete materials and ingredients, building materials, etc. Wm. Hutchinson is interested.

Washington, D. C.—The Southern Concrete Products Co. has been incorporated to manufacture and sell concrete and similar products, by Wm. A. Kennedy, Chas. H. Galliher, Clarence T. Kingsbury, Frank L. Averill and Fred Drew, all of this city.

PURCHASE OF MACHINERY.

Chicago, Ill.—(Special). The F. G. Lewis Mfg. Co., 1170 S. Robey st., advises us that it desires the names of firms who make kettles, dippers, buckets, etc., such as are used by paving contractors.

Portland, Ore.—(Special). P. Melhuish, care Warren Construction Co., is in the market for all equipment connected with road making.

Daytona, Fla.—(Special). D. D. Rogers, cy. engr., is in the market for a lightweight mountain transit.

Portland, Ore.—(Special). P. Melhuish, care Warren Construction Co., is in the market for dust preventives.

Williamston, S. C.—(Special). E. C. Horton is in the market for drain pipe for crossings, etc.

LIGHT, HEAT AND POWER.

Oklahoma City, Okla.—The Oklahoma Gas Engine Co. has been incorporated by A. Fishback, J. Worthington, W. F. Thor, F. Kabat, of this city, and W. G. Clark, G. Lowe, T. Clark, G. Clark, D. Clark and T. Lowe.

Oklahoma City, Okla.—The Union Gas & Electric Co. has been incorporated by F. L. Brandiger, C. W. Stephenson and F. D. Brown.

Champaign, Ill.—The Terminal Power Co., of McKinley, has been incorporated to produce and distribute electricity, gas, water, steam and hot water, by George W. Mattis, W. H. Carnahan and B. E. Bramble.

Decatur, Ill.—The Progressive Light & Power Co. has been incorporated to manufacture and sell electric current for power and lighting purposes, electricity and gas for heating, gas for illuminating, heating and power purposes, etc., by W. H. Suffern, Robert I. Hunt and Fred M. Ives.

Mt. Hope, W. Va.—The Varner Co. has been incorporated to build electric light and power plants, by J. F. Garrett and P. M. Snyder, of Mt. Hope; Alex. McNabb, J. W. Smiley and Samuel Dixon, of MacDonald, W. Va.

MISCELLANEOUS.

Milwaukee, Wis.—The Milwaukee Concrete Mixer Machinery Co. has been incorporated by W. J. Roseberry, R. J. Schwab and Henry E. Schwab.

Dundas, Ont.—Plans for a 4,000-ton crusher plant have been prepared for Doolittle & Wilcox. It will be erected on their property west of this city.

Cedar Rapids, Ia.—The Universal Crusher Co. has been incorporated by D. B. Getty, Jos. Cockfield, E. A. Velde, F.

F. Dawley and C. E. Wheeler, all of this city.

Moline, Ill.—W. L. Velie, of this city, has purchased a large stone crusher of the Austin-Western Co., of Chicago.

Normal, Ill.—This city has purchased a street sprinkler and sweeper of the Studebaker Mfg. Co., of South Bend.

Citico, Ala.—The Citico Furnace Co. has installed a No. 6 stone crusher, which was purchased of the Austin-Western Co., of Chicago.

Pacomai, Cal.—The Austin-Western Co., of Chicago, has sold a crushing plant to the Pacomai quarry.

Cedar Rapids, Ia.—The contract for crushers and other machinery for the new plant to be erected at Garrison, Ia., by the American Crushed Stone Co., was awarded to the Austin-Western Co., of Chicago. The new concern is composed of business men of this city.

Alexandria, La.—A. Wyckoff & Son Co. have established a wooden water pipe factory for the purpose of using the cypress lumber, so abundant in this region, in the manufacture of their water pipe for heads up to 200 pounds per square inch.

SEWER PIPE.

Indianapolis, Ind.—The William E. Dee Clay Co., of Illinois, has been incorporated here to manufacture, buy and sell and generally to handle and deal in sewer pipe, flue linings, drain tiles, etc., by Wm. E. Dee, L. B. Sauter and Ed G. Henkel.

Portland, Ore.—The Glazed Cement Sewer Pipe Co. has awarded a contract for the erection of a manufacturing plant in Kenton.

Rome, Ga.—The Standard Sewer Pipe Co., which was organized by D. B. Hamilton, Jr., and C. C. Harper, has purchased the plant of the Morrison-Trammell Brick Co., and will manufacture sewer pipe. New machinery will be installed.

New York City.—The annual meeting of the Sewer Pipe Distributers was held at the Hotel Astor, December 13. On account of ill health Arthur N. Pierson declined re-election as president, and Jas. G. Lincoln, of Boston, was chosen to fill the office. E. S. Walton, of Youngstown, O., was elected vice president; J. C. Adams, of Pittsburg, secretary and treasurer.

Patents on Concrete in Railway Track Construction.

906,067. Railway Tie. Hugh H. Ranje, Indianapolis, Ind.

906,686. Reinforced Concrete Railway Sleeper. Maurice Bruckner, Budapest, Austria-Hungary.

908,765, 908,766. Reinforced Concrete Track Ties. Wm. Gabriel, Detroit, Mich.

909,378. Reinforced Concrete Tie. Wm. Dunson, Indianapolis, Ind.

910,559. Railway. John J. Martin, Los Angeles, Cal.

911,734. Reinforced Concrete Sleeper for Railways and Tramways. Gaston Liebeaux, Nantes, and Francois Hennebique, Paris, France.

912,219. Reinforced Concrete Structure (railway track). Linn White, Chicago, Ill.

912,227. Reinforced Concrete Railway Sleeper. Maurice Bruckner, Budapest, Austria-Hungary.

912,663. Concrete Tie. Niels P. Frandsen, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Aurora, Ill.—The finance committee estimates that $298,920.30 will be needed to operate this municipality during 1910.

Peoria, Ill.—The report of Col. John Warner, superintendent of sidewalks, has been filed with the commissioner of public works, and it shows that during the present year about 70,000 lin. ft. of cement sidewalks have been laid.

Port Huron, Mich.—The hearing of the injunction petition of the State of Michigan vs. The Clyde Plank and Macadamized Road Co., which was set for Dec. 20, was continued to Dec. 29. The bill of complaint alleges that the defendant company has failed to keep its road in repair as required by statute. The defendant claims the circuit court has no jurisdiction in the case, and this is the point to be settled.

CONTEMPLATED WORK.

Hoquiam, Wash.—The city council will expend $90,000 in street improvements.

Pella, Ia.—The question of paving is being agitated here.

Atchison, Kans.—A resolution has been passed for paving Green st.

Trenton, N. J.—An ordinance has been passed for paving Olden ave.

Seward, Neb.—Council has decided to pave the streets around the public square.

Osage, Ia.—The city council has decided to pave 8 blocks of Main st. with concrete.

Richmond, Va.—This city has appropriated $50,000 for paving Franklin st. Address mayor.

Carmi, Ill.—Special.—Claude M. Barnes says 2 mis. of brick paving will be constructed.

Platteville, Wis.—Brick paving is contemplated next spring for Main st., from Court to Water sts.

East Moline, Ill.—Brick paving is contemplated for the bluff road, from 12th st. to Warner's Crossing.

Mitchell, S. D.—The question of paving the main street of this city is being urged by the business men.

Ames, Ia.—The city council has appointed a committee to investigate the matter of paving for this town.

Indianapolis, Ind.—A resolution has been passed providing for the paving of a portion of Washington boulevard.

Green Bay, Wis.—The estimated cost of paving contemplated during 1910 is $220,000. W. W. Reed, cy. engr.

Mason City, Ia.—Council will take final action, Jan. 10, for improving the alley in block 25, Paul Filt's plat.

Riverside, Ill.—Plans and specifications will be prepared for constructing paving, sewer and water improvements.

Onamia, Minn.—The question of issuing bonds for constructing roads in the town of Kathio is being discussed.

Pensacola, Fla.—Bids have been authorized for paving Paloff and Tarragona sts. L. E. Thornton, cy. engr.

Portsmouth, Va.—This city contemplates expending $200,000 for street paving during 1910. Bascom Sykes, cy. engr.

Saginaw, West Side, Mich.—About $142,000 is to be expended on road improvements in this county during 1910.

Springfield, Mass.—City engineer Farnham is preparing plans for the preliminary work for paving Allen, School and Dunham sts.

Creston, Ia.—Final action will be taken, Jan. 4, on the matter of paving several streets with asphaltic macadam, with concrete curbing.

Cincinnati, O.—J. N. Sundmaker, cy. engr., estimates the cost of brick paving in Rottermann and Lischer aves. at $14,487 and $9,992, respectively.

Akron, O.—Estimates have been submitted for road improvements as follows: Arlington st., brick, 317,343; Brittain road, brick, 319,393.

Beloit, Wis.—This city contemplates constructing 50,000 sq. yds. of brick, macadam and creosoted block paving. Robt. Caldwell, cy. engr.

Salina, Kans.—Special.—P. G. Wakenhut, cy. engr., advises us that W. Ash st. and the south end of Santa Fe ave. will be paved this year.

Abilene, Tex.—This city voted, Dec. 18, to issue $50,000 bonds for street improvements. Work in the downtown streets will begin early in 1910.

Prospect Park, Pa.—An ordinance has been passed providing $15,000 for macadamizing all streets in this town in which sewers have been laid.

Colorado Springs, Colo.—The question of paving the streets is under discussion and the various paving materials are being investigated.

Des Moines, Ia.—A petition has been submitted council asking for taroid macadam paving on 35th st., between Gravel ave. and Kingman boulevard.

Long Beach, Cal.—This city has authorized the grading, paving and curbing of Esperanza, Falcon, Gaviotta and Hermosa aves. F. L. Craig, prest. B. P. W.

La Crosse, Wis.—The bd. of pub. works has decided to pave 3 blocks of streets with brick, 11 blocks with asphalt, and construct curbing and gutters.

Little Rock, Ark.—Asphalt paving on concrete foundation, with brick gutters, is contemplated in the Louisiana st. district. E. A. Kingsley, supt. pub. wks.

Hastings, Neb.—Council has received a petition asking for paving in St. Joe and Hastings aves. and the blocks to the north, east and west sides of the court house.

Beaumont, Tex.—The special committee of the Jefferson County Good Roads Association has recommended the issue of $100,000 bonds for further road work in this county.

Crawfordsville, Ind.—Resolutions have been passed for paving College and Water sts. with asphalt, wooden cedar blocks, brick or bitulithic. H. B. Hulett, cy. clk.

Phoenix, Ariz.—The construction of a 6-in. crushed rock, oiled roadway in Central ave. is contemplated, at a cost of about $30,000. Major E. M. Laurson, secy. special road dist. No. 1.

Oconomowoc, Wis.—A resolution has been adopted providing for the paving of Milwaukee and N. Main sts. with permanent pavement on concrete base, with Portland cement curbs and gutters.

Rock Island, Ill.—A petition has been submitted to the board of local improvements asking that 3rd ave be paved with asphalt, to replace the present brick paving, which is in bad shape.

Jacksonville, Ill.—A contract will be let about April 1 for about 14,000 sq. yds. of asphalt paving in Prairie st., with 9,900 ft. of combined curb and gutter. C. W. Brown, engr.

Peoria, Ill.—The property owners in Adams st. are in favor of asphalt paving, and the bd. of supervisors favor brick paving. The city engineer has been directed to prepare estimates for paving Charles st. with brick.

Norman, Okla.—The city council has decided to pave 50 blocks of streets and will ask for bids for rock asphalt and petrolithic pavement. The council will spend the time until time for receiving the bids investigating the new pavement.

Mobile, Ala.—Estimates have been approved and bids will be asked soon for paving Water st. with concrete. Estimates will be prepared for paving, guttering and draining Spring Hill and Davis aves. and Broad st. Wright Smith, engr.

East Palestine, O.—Special.—C. E. Vaughn, surveyor and civil engineer, advises us that ordinances have been passed for paving 11,400 ft. of Clark and Martin sts. with brick or block, and the contracts will be let in the spring.

Beeville, Tex.—The city council has decided to employ Terrell Bartlett, C. E., of San Antonio, to make surveys of the entire city, establish grades, etc., with a view to extensive street lighting and the construction of a sewer system.

Freeport, Ill.—The street improvements for 1910 will probably include the following: Adams and Williams sts., 1 mi. of brick; Union st. and Deiter and Pleasant Park aves., 2-3 mi. of brick; Jefferson, High, Float and Rotzler sts., 2-3 mi. of macadam or brick; Douglas ave. and Powell st., 1¼ mi. macadam or brick; Whistler st., 2 blocks of brick. The contracts will be let in March. John A. R. Daniels, cy. engr.

CONTRACTS TO BE LET.

Shenandoah, Ia.—Bids are asked until Jan. 3 for paving Valley ave. Council.

Ft. Worth, Tex.—Bids are asked until Jan. 5 for paving Lipscomb st., from Terrell ave. to Capps st.

Ft. Leavenworth, Kans.—Bids are asked until Jan. 8 for grading 84,000 cu. yds. of earth. Capt. Wm. D. Davis, Q. M.

Jacksonville, Fla.—Bids are asked until Jan. 5 for resurfacing about 25 mis. of county roads. Gail L. Barnard, co. engr.

Little Rock, Ark.—Bids are asked until Jan. 18 for paving in the East 2nd st. improvement district. E. A. Kingsley, supt. pub. wks.

New Rochelle, N. Y.—Bids are asked until Jan. 6 for constructing curbs, gutters and sidewalks in Mayflower ave. Richard Lathers, Jr., chmn. B. P. W.

Cincinnati, O.—Bids are asked until Jan. 7 for improving Stone Mill road, from Colerain pike, at Dunlap, to county line. Fred Dreitis, clk. bd. co. comrs.

Lenoir, N. C.—Sealed bids are asked until Jan. 5 for macadamizing about 3 mis. of road near here and 3 mis. of additional road to be graded by the Lenois & Blow-

ing Rock Turnpike Co. R. L. Gwyn, secy. or treas. of company; C. M. Miller, engr., Salisbury, N. C.

Ada, Okla.—Bids are asked until Jan. 3 for 38,680 sq. yds. of paving, using Oklahoma rock asphalt on 5-in. Portland cement concrete base. P. G. Eckman, cy. engr.

Elk City, Okla.—Bids are asked until Jan. 10 for constructing 20 blocks of vitrified block paving, including grading, storm sewer, curbing, gutters, etc. R. L. Carlisle, cy. clk.

Ottumwa, Ia.—Bids are asked until Jan. 3 for 16,000 sq. yds. brick paving on concrete base, 1,200 sq. yds. of creosoted block paving and 10,000 lin. ft. cement curb. J. T. Brady, cy. engr.

New York City.—Bids are asked until Jan. 4 for furnishing cement, sand and broken stone, and for furnishing and putting in place small cobble and riprap stone. Allen N. Spooner, comr. docks and ferries.

New Berne, N. C.—Bids are asked until Jan. 4 for constructing about 48,000 sq. yds. of brick paving, with cement filler; brick, with sand filler; bitulithic and asphalt macadam; all or part to be made in either kind of pavement. F. T. Patterson, cy. clk.

CONTRACTS AWARDED.

San Diego, Cal.—The contract for improving 17th st. was awarded to M. D. Goodbody for $7,989.51.

San Bernardino, Cal.—B. F. Ford & Co. were awarded the contract for macadamizing D st., for $25,514.

South Bend, Ind.—The contract for paving N. Eddy st. with asphalt macadam was awarded to C. H. Defrees, Dec. 8.

Long Beach, Cal.—White & Gaskell, of this city, secured the contract for 206,000 sq. ft. of paving, for $11,500.

Tacoma, Wash.—The Barber Asphalt Paving Co. was awarded the contract, Dec. 11, for $98,671.

Trenton, N. J.—The contract for resurfacing Chambers st. with Warrenite was awarded to the United Paving Co. for $6,700.

Red Bank, N. J.—The contract for paving Front st. was awarded to Charles E. Burd, of this city, at $2.35 a cu. yd.

Bellaire, O.—The contract for paving the Bellaire and Rhodyside pike was awarded to W. J. Berry, of Powhatan, for $25,000.

Hubbard, O.—The contract for constructing sidewalks in E. Liberty st. was awarded to F. L. Keys.

St. Joseph, Wis.—The contract for paving Francis st. with asphalt was awarded to the Metropolitan Construction Co. at $1.55 a sq. yd.

Jennings, La.—The contract for constructing 7 or 8 mis. of cement sidewalk was awarded to De Jersey & Bernard, of Minden, La., for $30,000.

Prescott, Ariz.—Sines & Rockmark secured the contract for constructing a 6-in. crushed rock, oiled roadway in Central ave., for about $30,000.

Eaglewood, N. J.—Edward English was awarded the contract for constructing a concrete sidewalk and macadamizing West End ave., for $7,500.

Piper City, Ill.—The contract for paving the streets was awarded, Dec. 23, to Contractor Finley, of Hoopeston, Ill., for $14,780.

Houston, Tex.—The contract for paving Washington ave., San Jacinto and Travis sts. with brick was awarded to A. T. Lucas, for $31,988.

Houston, Tex.—The contract for grading the Houston and Clodine road for a distance of about ½ mi. was awarded to Sunderman & Dobson, at 12¾ cts. a cu. yd.

Pulaski, Va.—The lowest bid submitted Dec. 11 for constructing 2.6 mis. of road in Pulaski county was by Warden, Hattel & Co., of this city, for $12,785.

Vicksburg, Miss.—The bids submitted Dec. 6 for paving a number of streets with vitrified brick, granitoid, bitulithic, asphalt, mineral rubber and creosoted wooden blocks were returned unopened.

New Orleans, La.—The Metropolitan Construction Co. was awarded the contract for paving with Sarco for $207,724.92, and James A. Craven Co. the contract for square granite block paving in Julia st. for $5,810.20.

Arkansas City, Ark.—Special.—The contract for paving Chestnut ave. and 6 alleys with paving blocks, on 6-in. concrete base and asphalt filler, was awarded to Rushmore & Gouty, of Cherryvale, Kans., at $1.53 a sq. yd.

Asheville, N. C.—The contract for macadamizing Spring st. was awarded to the French Broad Quarry Co. for $7,235. B. J. Luther & Co. were awarded the contract for constructing a boulevard through the property of the Kenilworth Land Co.

Atlantic City, N. J.—The contract for constructing the Chelsea board walk between Texas and Albany aves. was awarded to Wilbert Beaumont, of this city, for $18,627. The walk will consist of a concrete substructure, with wooden decking.

Akron, O.—Bids were submitted Dec. 14 for street and sewer improvements, as follows: Valley st. paving, from Crosby to Silver sts., Hunt & Wigley, $5,684; Dan O'Marr, $5,656; Wildes & Davidson, $3,439; McAntonan Bros., $6,147; John O'Neil, $5,866. John T. Payne is city engr.

New York City.—The contract for repaving Bement ave. and other streets with vitrified brick was awarded to Joseph Johnson's Sons, 193 Broadway, West New Brighton, S. I., for $7,127. The Asphalt Construction Co. was awarded the contract for repaving with asphalt blocks on concrete, Park ave., East, for $12,038, and the Asphalt Construction Co. the contract for repaving a number of streets with old granite blocks, for $82,131.

Columbus, O.—Contracts for improving 16 streets and constructing 3 sewers were awarded as follows: J. C. Beasley, Detroit ave., at $1,848; Budd & Bartling, Columbus, have the contract to pave Duxbury ave. with Athens block at $3,685, also to pave Wilco ave. with the same material for $2,454; W. H. Graham secured the contract to pave Elm st. with Athens block and tar filler, at $1,285, also to pave Morrill ave. with Peebles brick, at $2,412; H. J. Shaw, Columbus Savings & Trust Bldg., was given the contract to pave 5th ave. with Athens block, one section for $3,656 and the other section for $6,885; H. E. Barthman was awarded the contract to pave Locust st. with Athens block, for $1,371; Geigle & Garnes, Columbus, were let the contract to pave Mink st. with Athens block, for $2,043; A. G. Pugh was given the contract to pave 22nd st. with California asphalt, at $8,067; H. J. Shaw was given the contract to pave Price st. with Metropolitan block, for $8,460.

SEWERS.

Victor, Colo.—The city council passed an ordinance, Dec. 10, revoking the franchise of the Victor Sewer Co., and declared that the plant of this company should become the property of the city upon the payment of its fiscal value, which is estimated at $73,000.

CONTEMPLATED WORK.

Essex, Ia.—A sewerage system is contemplated.

Canby, Minn.—Plans have been prepared for a sewer system.

Allentown, Pa.—The need of a sewerage system in this city is being urged.

Imperial, Cal.—Voted to issue $40,000 bonds for constructing a new sewerage system.

Huron, S. D.—Council has decided to construct a sewer in Frank st.

Montevideo, Minn.—Council has adopted plans for sewers in 5th st. and Mlawaukee ave.

Yoakum, Tex.—The question of a modern sewerage system here is urged. Mayor Price.

Hoquiam, Wash.—Specifications have been completed for constructing a trunk sewer.

Beaumont, Tex.—Will vote, Jan. 14, on the issue of $150,000 for drainage improvements.

Osakis, Minn.—Special.—T. H. Borchus says a septic tank for the sewerage system is contemplated.

Colton, Cal.—Voted to issue bonds for constructing a sewerage system. W. L. Brown, co. engr.

Belle Plaine, Ia.—Council has ordered a survey made for a sewer outlet, septic tank, etc.

Glendale, O.—Will vote, Jan. 25, on the issue of $75,000 bonds for constructing a sewerage system.

Stoughton, Wis.—Plans for a complete sewerage system have been prepared by Z. T. Hurd, cy. engr.

West Dundee, Ill.—The establishment of a sanitary sewer district is proposed. Mayor Shedden.

Lewistown, Ill.—The contract will probably be let about Feb. 1 for constructing sanitary sewers.

Ft. Smith, Ark.—The report of Samuel M. Gray, of Providence, R. I., on the sewerage system has been submitted

Colorado Springs, Colo.—City Engr. Waggener estimates the cost of building the proposed storm sewers at $50,000 to $60,000.

Corsicana, Tex.—An ordinance has been passed authorizing the issue of $20,000 bonds to extend the sewerage system.

Palestine, Tex.—The city commissioners are considering the construction of 15,000 additional feet of pipe sewers.

Savannah, Ga.—Will probably vote in February on issue of bonds for extension of sewerage system. J. W. Howard, cy. engr.

Sandusky, O.—Plans have been prepared for rebuilding 2,500 ft. of 10, 12 and 15-in. sewer in Franklin st. C. M. King, cy. engr.

Houston, Tex.—Plans and specifications have been completed by F. L. Dormant for sanitary sewers in the 2nd and 3rd wards.

Macon, Ga.—Voted Dec. 8 to issue $400,000 bonds for constructing a sanitary sewerage system and paving in Vineville.

Maplewood, N. J.—Ordinances have been passed for constructing sewers in South Orange twp. Edward R. Arcularius, twp. clk.

Beeville, Tex.—The city council has engaged Terrell Bartlett, of San Antonio, to make surveys of the entire city, with a view of constructing a sewerage system.

McKeesport, Pa.—Messrs. Duncan, Johnston and Block have been appointed a committee to employ assistants for the city engineer to prepare sewer plans.

Lebanon, Pa.—Will vote in February on issue of $115,000 bonds for constructing a comprehensive sewerage system and enlarging three natural waterways within the city limits.

Greenfield, Mass.—The sewer committee has decided to recommend the construction of an intercepting sewer to prevent the present pollution of Green river. Geo. F. Merrill, chmn.

La Crosse, Wis.—The bd. of pub. wks. has decided to construct a sedimentation basin at the foot of Pine st. and a main in Pine st., at a cost of $190,000, and sewer construction at cost of about $10,000.

Ely, Nev.—Special.—Alfred B. Colwell, cy. engr., has been authorized to retain the services of Alexander Potter, consulting engineer of New York City, in connection with the designing of a sewage disposal plant for this city. The plant will be constructed in the opening of 1910.

New York City.—Special.—M. T. Richardson, P. O. Box 654, desires to communicate with mnfrs. of a distributing apparatus for sewage systems, where a half dozen beds are prepared and the sewage is conducted to each bed in rotation, giving each bed an opportunity to rest for six days.

CONTRACTS TO BE LET.

Prince Rupert, B. C.—Bids are asked until Jan. 19 for installing sewage wks. Dept. Pub. Wks.

Sapulpa, Okla.—Bids are asked until Jan. 10 for constructing a brick trunk sewer. Ira J. Anderson, cy. clk.

Lawrence, Kans.—Sealed bids are asked until 5 p. m., Jan. 3, for constructing lateral sewers. F. L. Brooks, cy. clk.

Meadville, Pa.—Bids are asked until 8 p. m., Jan. 5, for constructing a sewer in Grove st. H. S. Robinson, cy. clk.

Marion, Ind.—Bids are asked until Jan. 8 for constructing the Clement I. Coble ditch. D. M. Murphy, impvt. comr.

St. Paul, Minn.—Bids are asked until Jan. 6 for constructing 4 state ditches. Geo. A. Ralph, engr. State Drainage Com.

Columbia, Mo.—Bids will probably be asked about Jan. 15 for constructing pipe sewers. John S. Bicknell, cy. clk.

Muskegon, Mich.—Bids are asked until Jan. 28 for constructing sewers in sewer dist. No. 7. Benjamin H. Tellman, cy. recdr.

Holton, Kans.—Bids are asked until Jan. 12 for constructing a sewerage system and disposal plant. G. H. Merrill, cy. clk.

Batavia, N. Y.—Bids are asked until Jan. 5 for constructing a sewage well at the municipal plant. Bd. sewer comrs.

Charleston, S. C.—Bids are asked until Jan. 11 for constructing pipe sewers and appurtenances. J. H. Dingler, cy. engr.

San Francisco, Cal.—Bids are asked until Jan. 5 for constructing sewers in secs. A, B, C, D and E, Yerba Buena district. B. P. W.

Hebron, Neb.—Bids are asked until Jan. 12 for constructing 13,000 ft. of lateral sewers, 12 flush tanks, 25 manholes, etc. O. P. Hees, cy. clk.

Denver, Colo.—Bids are asked until Jan. 14 for constructing district sewers, submains and other appurtenances in West South Side sanitary sewer district. B. P. W.

Detroit, Mich.—Bids are asked until Jan. 5 for furnishing and erecting machinery for a sewage pumping station at the foot of Parkview ave. Jacob J. Haarer, comr.

Toronto, Ont.—Bids are asked until Feb. 15 for constructing sewer outlet, sewage tanks and supply of steel, c. i. pipe, sludge valves, etc. Joseph Oliver, mayor.

CONTRACTS AWARDED.

Oklahoma City, Okla.—Bouse & Bouse secured the contract for constructing sewers for $67,973.50.

Springfield, Ill.—The contract for constructing sewers in certain streets was awarded to Chas. Bird.

Rochester, N. Y.—The contract for building a sewer in Wolcott st. was awarded to the John Petrossi Co. for $4,336.

Bay City, Mich.—The contract for constructing a 10-in. socket tile sewer in Washington ave. was awarded to Thomas Morrison.

Chicago, Ill.—The Federal Improvement Co. has been awarded a contract for constructing a sewer in S. 52nd ave., for $288,240.

Lubbock, Tex.—The contract for constructing a sanitary sewer system and a septic tank was awarded to O. Leon Dalton, of Dallas.

Elmwood, O.—The contract for constructing a sewerage system was awarded to Paul Menges for $30,546.08, and $15,482 for the disposal plant.

Goshen, Ind.—The contract for constructing 25 mis. of ditch in Hamilton Co. was awarded to the Elkhart Construction Co., of Elkhart, for $60,000.

Houston, Tex.—The contract for constructing a sanitary sewer in the 5th ward was awarded to Kelso & Vautrin, of Galveston, for $72,726.35.

Oklahoma City, Okla.—The Tulsa Engineering and Construction Co., of Tulsa, Okla., was awarded the contract for constructing certain sewers in Deep Fork addition.

Rock Island, Ill.—The contract for building a sewer system in the 6th ward was awarded to the People's Construction Co., of Davenport, for $47,580.56.

Wichita, Kans.—Sewer contracts have been awarded as follows: College Hill, John Shiffler, of Springfield, Mo., $119,279.81; Riverside, Ely Construction Co., of Wellington, $36,107.88.

Minneapolis, Minn.—The contract for construction of sanitary sewers was awarded to the R. J. & W. M. Boyd Construction Co., 200 Southwest Boulevard, Kansas City, Mo., for $27,928.

Providence, R. I.—The contract for constructing a sewer system in the Watchemoket section of East Providence was awarded, Dec. 8, to A. G. Tommasito, of Dorchester, Mass., for $64,844.80.

Detroit, Mich.—Contracts for constructing the new Fairview sewer were awarded, Dec. 17, as follows: 1st section, 1,761 ft., James Pauley, $24,644.38; 2nd section, 3,700 ft., Langley Jeynes, $46,665.

Grand Rapids, Mich.—The contract for constructing a sewer in Walker ave. was awarded to Verhey & Kloet for $23,743.84. Kloote & Vanderveen secured the contract for a sewer in Watkins st. for $646.80.

Arkansas City, Ark.—Special.—Sewer contracts were awarded, Dec. 21, as follows: E. M. Eby, of Wellington, Kans., 3½ mis. 6-in. sewer, 68 cts.; 8-in., 90 cts.; 10-in., $1; 15-in., $1.30; manholes, $40; lampholes, $10; flush tanks, $75; each additional foot of manhole over 6 ft., $3. Robson & Livingston, of city, 900 ft. lateral 6-in. pipe, 65 cts.; manholes, $35; lampholes, $5; flush tanks, $75.

WATER WORKS.

Allen, Tex.—The Allen Water Co. has been incorporated by S. P. Brush, J. Weiley Young and J. M. Hugnley.

Youngstown, O.—The Mill Creek Water Supply Co. has been incorporated to furnish a domestic water supply to the city.

Omaha, Neb.—The Omaha water works case will be argued before the United States Supreme Court at Washington, D. C., early in January.

Carthage, Mo.—The plant of the Carthage Water & Power Co. has been dismantled and closed down, shutting off the city's water supply, as a result of Judge John Phillips' decision in the federal court at Kansas City, in which he denied the right of the city to interfere with G. Ralph Leighton, grantee of the Carthage Water & Power Co. Federal litigation had prevented Leighton from discontinuing the water service Nov. 15, as he announced he would until the decision of Judge Phillips was rendered.

CONTEMPLATED WORK.

Hettinger, N. D.—A water works system is contemplated.

Peru, Neb.—Plans are being prepared for a water works system.

Green Lane, Pa.—Voted to erect municipal water plant.

Callaway, Neb.—The construction of a water supply system is contemplated.

Hibbing, Ill.—The improvement of the water works system is contemplated.

Pluton, Wash.—Plans are being considered for a water works system.

Vandalia, Mo.—Voted to issue bonds for a water works and sewerage system.

Wildon, Colo.—This city contemplates installing 2 more slow sand filters.

Jonesboro, N. C.—Voted to issue bonds for constructing a water works system.

Albany, Ga.—The city council decided, Dec. 7, to install water works.

Albion, N. Y.—The establishment of a new water service is still being urged.

Midland, Tex.—This city voted to issue $50,000 bonds for constructing a water works system.

Calixico, Cal.—The board of trustees contemplates establishing a new municipal water works system.

Wakefield, Kans.—Plans are being prepared for the construction of a water works system.

Texarkana, Ark.—Voted to issue $200,000 bonds for a municipal water works plant.

Foss, Ark.—Voted to issue bonds for constructing a water works and sewerage system.

Guthrie, Okla.—Voted to issue bonds for the improvement of the water system, sewer system, parks and fire service.

Saginaw, Wash.—Council approves the plan of holding an election to vote on the question of reconstructing the water system.

Jackson, Miss.—The city council voted in favor of a $100,000 bond issue for the construction of a filtration plant.

Denison, Tex.—Plans have been prepared for the extension of the water mains south of Day st. and extensions north of Main st.

Norfolk, Va.—Thos. B. Dornin, chief engineer of the water dept., urges a larger and better equipped water supply for this city.

Arkansas City, Ark.—This city contemplates an increased water supply and extension of the water mains. J. H. Matthews, cy. engr.

Kearney, Mo.—Plans and specifications have been completed for the construction of a water works system. G. E. Ford, cy. clk.

El Centro, Cal.—The city trustees will engage the services of an expert engineer to prepare plans and specifications for water works.

Joliet, Ill.—A public hearing will be held Jan. 3 to consider plans, profiles and resolutions for a high-pressure water system.

Oklahoma City, Okla.—Voted to issue bonds for extra pumps, new dam and additional main. Bids will be asked in a few weeks. W. C. Burke, cy. engr.

Conway, Ark.—Special.—The comrs. of water works improvement district No. 1 are prepared to receive bids for an 8-in. deep well. Geo. Watson, secy.

Cuthbert, Ga.—Special.—This city sold $20,000 5 per cent. 30-yr. water and light improvement bonds to John W. Dickey, of Augusta, Ga., for $20,774, accrued interest and printing of bonds.

Lorain, O.—The report of the superintendent of water works on the extension of the water works intake and additional pressure stations for the 4th ward has been accepted by the city council.

CONTRACTS TO BE LET.

Broken Arrow, Okla.—Bids will be received about Feb. 1 for constructing a water works system.

Aberdeen, Wash.—Bids are asked until Jan. 5 for furnishing c. i. pipe and valves. P. T. Clark, cy. clk.

Ft. Robinson, Neb.—Bids are asked until Jan. 3 for alterations to a pump house. Capt. F. L. Arnold, constr. Q. M.

Cawker City, Kans.—Bids are asked until Jan. 11 for constructing a water works system. G. B. McKinley, cy. clk.

Erie, Kans.—Bids will be opened about Jan. 15 or 20 for constructing a water works system. J. C. Denison, cy. clk.

Dodgeville, Wis.—Bids are asked until Jan. 4 for furnishing and erecting a cypress wood or steel tank. Henry Halverson, cy. clk.

Irondequoit, N. Y.—Bids are asked until Jan. 4 for constructing a water works system. J. E. Summerhays, secy. Summerville water dist. in town of Irondequoit.

Vancouver, B. C.—Bids are asked until Jan. 12 for the annual water supply material, including 10 mis. of 12, 8 and 6-in. steel and iron pipe, and 250 tons of 4-in. c. i. pipe. W. A. Clement, cy. engr.

Parkersburg, W. Va.—Bids are asked until Jan. 6 for constructing 37,150 ft. of 6, 8, 10 and 12-in. c. i. pipe for additional water supply, with hydrants, valves and valve boxes. Frank Good, cy. audt.

Lamar, Colo.—Bids are asked until Jan. 9 for constructing a reinforced concrete headgate, reinforced concrete riprapping, etc., at Chivington reservoir No. 4, 2 mis. south of Brandon Station. Chivington Canal Co.

Jackson, Miss.—Bids are asked until Jan. 22 for boring the necessary artesian wells and furnishing machinery for pumping the same for the use of the city water works. Hamilton Johnson, genl. mgr. water works.

New York City.—Bids are asked until Jan. 11 for constructing portions of White Plains division of Catskill aqueduct, including 3 tunnels and about 2¼ mis. of plain concrete conduit. J. Waldo Smith, ch. engr. bd. water supply.

Wilmington, N. C.—Bids are asked until Jan. 12 for constructing a brick power and filter house, machinery foundations, rearrangement of machinery, radial brick stack, extension to filter plant, sedimentation basin, and concrete storage reservoir. Chas. W. Worth, chmn. water and sewerage bd.

CONTRACTS AWARDED.

Lubbock, Tex.—The contract for constructing a water works system was awarded to E. Leon Dalton, of Dallas.

Rock Island, Ill.—The contract for laying a water main in Eight-and-a-half ave. was awarded to P. F. Treukenschuh.

San Francisco, Cal.—The contract for constructing Twin Peaks reservoir was awarded to the Healy-Tibbitts Construction Co. for $158,143.

Gotebo, Okla.—The contract for constructing a water works system was awarded to F. C. Brooks & Sons, of Jackson, Mich., Dec. 18, for $24,180.

Lake Village, La.—The contract for constructing a tower, power house and laying water mains was awarded to Justin Matthews, of Little Rock, Ark.

New York City.—The contract for building the Hillview reservoir, below Mt. Vernon and Yonkers, was awarded to the Millard Construction Co., of Philadelphia, for $2,350,000.

Dallas, Tex.—The United States Cast Iron Pipe Co. was awarded the contract for furnishing 5,334 tons of 8 to 36-in. pipe, at $27.70 a ton, and $50 for specials, or a total of $147,750.

Reading, Pa.—The contract for furnishing and erecting pumping machinery at the pumping station at Hampden reservoir was awarded to Fairbanks, Morse & Co., of New York City, for $8,750.

Gulfport, Miss.—The contract for extending the water works system was awarded, Dec. 9, as follows: Fire hydrants, Chattanooga Iron Works; valves and valve boxes, Fairbanks Company, New Orleans; cast iron pipe and special castings, American Cast Iron Pipe Co., Birmingham, Ala.; digging artesian well, Brown Deep Well Co., New Orleans; construction of pumping station, Chevally & Ferguson, Gulfport; screw plugs, Columbia Iron Works, Chattanooga, Tenn.

BRIDGES.

Nashua, N. H.—A new bridge is contemplated to replace Taylors Falls bridge by the city council.

Cohoes, N. Y.—Bids are asked until Jan. 4 for erecting a bridge with concrete floor. Geo. T. Bollin, cy. engr.

Goliad, Tex.—The contract for building a bridge across Blanco river was awarded to J. J. Greathouse for $3,559.

Des Moines, Ia.—A petition will be circulated asking for the construction of a bridge over the Des Moines river at North street.

Geneva, Neb.—Bids are asked until Jan. 11 for erecting all county bridges during the year. Uriah F. Standard, co. clk.

Bristol, Tex.—This city contemplates the construction of an iron bridge across Beaver creek, on Front st. Address mayor.

Portsmouth, Va.—This city contemplates the construction of 3 reinforced concrete bridges during 1910. Bascom Sykes, co. engr.

West Union, O.—Bids are asked until Jan. 17 for constructing a steel bridge with concrete floor. E. C. Zimmerman, co. surveyor.

Ft. Dodge, Ia.—Plans and specifications have been submitted to city council for a viaduct to be constructed at S. 3rd st.

Pensacola, Fla.—Santa Rosa and Escambia counties contemplate the construction of a steel bridge over Escambia river, near McDavid.

Monroeville, O.—Bids are asked until Jan. 24 for erecting a steel riveted truss bridge over Huron river. Jay E. Smith, co. audt.

Florence, Ariz.—Bids are asked until Jan. 15 for constructing a highway bridge

over the Gila river. J. B. Girard, territorial engr., Phoenix.

Pueblo, Colo.—Sealed bids are asked until 4 p. m., Jan. 3, for constructing a bridge across the Arkansas river, at Union ave. D. P. Gaymonecy.

Woonsocket, R. I.—A resolution has been passed providing for the construction of a highway bridge over Blackstone river, at River st., to Cold Spring Park. City council.

Little Rock, Ark.—This city has appropriated $5,000 for the construction of a concrete bridge over Swaggerty branch, on High st. E. A. Kingsley, cy. engr.

Grand Island, Neb.—Bids are asked until Jan. 12 for constructing and repairing all steel, wooden, pile and truss bridges for 1 yr. G. H. Poell, co. clk.

Cincinnati, O.—Bids are asked until Jan. 7 for the repair of the east abutment of the bridge over the Little Miami river, on the New Richmond pike, Anderson twp. Stanley Struble, prest. co. comrs.

Dallas, Tex.—Sealed bids are asked until Jan. 15 for constructing a steel highway bridge and viaduct over Trinity river, about 5 mis. south of this city. Geo. L. Fearn, co. audt.; J. F. Witt, co. engr.

Lamar, Wash.—Bids are asked until Jan. 4 for constructing a bridge on concrete piers and abutments, with retaining walls, across Touchet river, at the Harve Shaw crossing, near here. J. N. McCarr, co. audt.

Winnipeg, Man.—Bids are asked until Jan. 18 for removing the present superstructure and erecting a new superstructure and floor complete for Louise bridge, across Red river. M. Peterson, secy. bd. control.

STREET LIGHTING.

Vine Grove, Ky.—The construction of an electric light plant is contemplated.

Winchester, Tenn.—Bonds for improving the municipal electric light plant have been sold.

North Syracuse, N. Y.—Plans are being considered for lighting the streets of this village.

Essex, Mass.—The question of lighting the streets by electricity is under consideration.

Athens, Mich.—The plant of the Athens Electric & Power Co. was destroyed by fire Dec. 12.

Pocahontas, Ia.—Will vote, Jan. 14, on the issue of bonds for constructing a lighting and heating plant.

Northfield, Vt.—The extension of the municipal electric light system to Northfield Junction is contemplated.

Salt Lake City, Utah.—Plans are being considered for constructing a municipal electric light plant. John S. Bransford, mayor.

Colorado Springs, Colo.—Plans are being considered for constructing a new electric light and power plant here.

Oak Park, Ill.—Plans are being prepared for an addition to the power plant of the Oak Park Light, Heat & Power Co.

Princeton, N. J.—The borough council is considering plans for the improvement of the lighting system.

Charleston, Miss.—Improvements are contemplated for the municipal electric light, water works and sewerage systems.

Terra, Alta.—An electric light plant will be established by J. A. Martin, who is having plans made for a power house.

Hill City, Kans.—The question of constructing an electric light plant is under consideration. A. G. Morris, cy. clk.

Brockport, N. Y.—A. L. Swett, of Medina, has purchased the Albion electric light and power plant, which supplies this village with electricity.

Greenville, Ga.—Bids are asked until Jan. 4 for the purchase of bonds for the purpose of installing a lighting plant, a sewerage system and a water works plant.

Fargo, N. D.—Bids are asked until Jan. 5 for furnishing and installing an electric light plant at the county hospital. Arthur G. Lewis, co. audt.

Ft. Williams, Me.—Bids are asked until Jan. 20 for constructing and remodeling an electric light system here. Capt. C. F. Humphrey, Jr., constr. Q. M.

Chehalis, Wash.—Special.—The town council has under consideration the matter of changing from the arc system of lighting to incandescent. H. C. Coffman.

Los Angeles, Cal.—A resolution has been adopted providing for the construction of a municipal electric plant in connection with the Owens river project. H. J. Lelande, cy. clk.

Canandaigua, N. Y.—The installation of an electric light plant at the court house for the use of the court house and jail has been recommended by the board of supervisors and committee.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Portland, Ore.—Bids are asked until Jan. 3 for constructing a new garbage crematory. Cy. audt.

Buffalo, N. Y.—Special.—Wannenwetsch & Co., Citizens' Bank Bldg., desire the names and addresses of the manufacturers and builders of incinerating plants.

PARKS.

Bayonne, N. J.—The Hudson county park commission has selected two sites for county parks in this city.

Glen Ridge, N. J.—Mayor Mead has decided in favor of transferring the park lands in this borough to the Essex park commission.

Knoxville, Tenn.—An ordinance has been passed providing for the issue of $50,000 bonds for park purposes. John M. Brooks, mayor.

FIRE APPARATUS.

Quincy, Ill.—The purchase of a new fire engine is contemplated.

Peoria, Ill.—A practical illustration of the working of the Gamewell fire alarm telegraph system will be made in this city.

Minneapolis, Minn.—The fire committee of the council has recommended that bonds be sold for the purchase of new fire apparatus.

Springfield, Mass.—The contract for installing a new fire alarm telegraph system in the new fire headquarters in Dwight st. was awarded to the Gamewell Fire Alarm Telegraph Co., of New York City, for $30,000.

Gulfport, Miss.—The contract for installing a fire alarm system was awarded to the Gamewell Fire Alarm Telegraph Co., of New York City, for $3,500.

MUNICIPAL ENGINEERING

VOLUME XXXVIII. FEBRUARY, NINETEEN HUNDRED TEN. NUMBER TWO

TOWN SCAVENGING AND REFUSE DISPOSAL.

Special Street Cleaning Services.

By Hugh S. Watson, A. M. I. C. E., London, Eng.

DAY Service on Roads.—During the day time street orderlies are employed in most large towns to collect the paper and other matter which is continually being deposited upon the road surfaces. These are drawn to the roadside and collected either in specially provided street orderly bins or in small hand carts. In many of the London boroughs, where the whole of the ground beneath the pavement is occupied by service pipes of various descriptions, the bins are constructed of galvanized iron, and are stood in convenient positions on the sidewalks; collecting carts are sent around to empty them as often as they are able, having regard to the interference caused by the traffic. They are generally emptied about three times a day.

In the city of Westminster, in Glasgow, and in many other provincial towns, the orderly bins are placed underneath the sidewalks, removable covers being provided for emptying them. The bins have an outlet to the sewers, which is guarded by means of a grating to prevent solid matter from escaping, and also by having a perforated basket placed immediately over the opening.

Water carts are sometimes employed having a single jet which plays upon the refuse that has been collected in the gutters, and so conveys it to the bins, the water passing away into the sewers. Small hand carts are also very often used.

In the outlying metropolitan boroughs, such as Kensington, and in many provincial towns, hand carts are relied upon entirely, the street orderly boys sweeping the refuse up into heaps, when the barrow men come around and remove them to some quiet part where they can be transferred into the collecting carts. The boys are usually provided with scrapers and brooms in dry weather, and with "squeegees" in wet weather.

The hours worked and the number of boys required for any length of street vary in different districts, depending upon the nature and amount of the traffic on the roads. In the metropolitan borough of Finsbury they they come on duty about 8 a. m. and work until 6 p. m. In the city of London they are employed from 7:30 a. m. until 5 p. m. in summer and 4:30 p. m. in winter. In Leeds the hours are from 7 a. m. till 4 p. m.

In those metropolitan boroughs in the neighborhood of the city proper three orderlies are employed per mile of 30-foot road, but in outlying districts, on roads subject only to ordinary traffic, one per mile would probably be sufficient.

The orderlies are rarely employed on Sundays, the roads generally being left after the night or early morning sweeping has been accomplished, as the case may be.

Street Watering.—Street watering is almost as important as the daily cleaning of the streets themselves, on account of the amount of dust created by the wear and tear of the street surfaces, and this has increased much of late years owing to the introduction of motor traffic. The only surfaces which are not usually watered for their entire width are wood pavements, which are rendered dangerous for some time after the application of the water, both to horses and to cyclists. If they are watered then it is necessary to shingle (sand) the streets immediately afterward in order to give a foothold to horses. As a rule, however, if the streets are properly cleaned by flushing or with rotary ma-

chine broom each night, or in the early hours of the morning, there will be no necessity to do anything further to them. All other kinds of surfaces, however, will require to be watered in dry or dusty weather, and this frequently has to be done in the main roads of our larger cities as often as four or five times a day.

The watering can be performed either by means of motor water vans or by horse-drawn vehicles. The former have been in use for some time in the city of Westminster, and have given entire satisfaction. A petrol (gasoline automobile) water van with rubber tires on all wheels has also been tried, and it has proved most useful, on account of the fact that it can move at the same rate as the fast traffic, so that no obstruction is caused by its use. A water cart has also been attached to a small motor, and used for street watering purposes in Liverpool, where it has been found very satisfactory. Horse-drawn vehicles are more generally used in the London metropolitan boroughs, the areas of which are small in comparison with the area covered by many of our larger provincial towns. The carrying capacity of the carts varies from 300 to 450 gallons, depending upon the nature of the district. The water is drawn from special standpipes, and is measured by meter. In some seaside towns salt water is used for the watering of the streets, and is generally considered to be more lasting in its effect, while it also has a disinfecting influence.

Where ordinary water is used a disinfectant of some description is generally added to it. This either takes the form of Sanitas or Kuna-pine blocks, or a weak solution of either carbolic or permanganate of potash. The Sanitas blocks cost one shilling (25 cents) each, and one will generally be sufficient for about 2,000 gallons of water.

The methods which have been in use at Poplar for the past two or three years for producing a cheap and at the same time powerful disinfectant by electrolytic means are worthy of attention. Dr. Alexander, the medical officer of health, in his annual report for the year 1908, points out that this electrolytic disinfectant has been prepared under his own supervision during the last three years, during which time no other disinfectant has been used for road watering or for other purposes in the borough. During the year 1908 28,280 gallons of the fluid were manufactured, the cost being only 56 pounds ($280). Dr. Klein, bacteriologist to the local government board, has certified that one ounce of the fluid to 150 ounces (nearly one gallon) of water will kill the cholera germ in 2½ minutes. Experiments have shown that, diluted 200 times, this disinfectant forms a suitable and effective solution for road watering, and it is probable that being so much more active than those generally in use, and its production being a simple and inexpensive matter, this electrolytic disinfectant will be much more used in the future for road watering and similar purposes. Chlorine has also been used as a disinfectant. Specially made jars are fixed in the vans which allow the solution of chlorus to escape gradually.

Various forms of patent sprinklers are in use, the simplest of which consists of an ordinary perforated iron tube. Others are fitted with valves which enable the driver to regulate the width of spray and the volume of water distributed. A very convenient sprinkler is used by the corporation of Bristol. This consists of a four-wheeled tank which is arranged to throw the water from the back corners near the ground with either a heavy or light spray. It covers a space 24 feet wide, and can also be used for washing streets by using the heavy flow. The distance that can be watered by a van in any day will depend entirely upon the weather conditions, but each van can roughly distribute about ten loads per day.

Shingling of Roads.—The spreading of shingle (sand or fine gravel) on slippery and greasy roads is an important duty of the cleansing staff. This work is generally attended to by the street orderlies.

Granite pavements require shingling in almost all kinds of weather on steep gradients, but it is not necessary to shingle them on the level except in greasy or frosty weather. Smooth asphalt pavements will invariably require shingling in greasy or frosty weather. Wood pavements should not be shingled unless they have been watered (and, as the author has already explained, it is preferable not to water them), as the dust of the shingle will be blown about as soon as the pavement is dry. The shingle used should be fine grit which is capable of being passed through a screen not more than ⅜ inch mesh.

Refuse destructor clinker has been tried for the shingling of streets, but it has not been found satisfactory, as it disintegrates too easily, and then forms further dust.

Shingling should be carried out as sparingly as possible, since it must be recollected that the whole of the shingle put down will have to be taken up again after it has served its purpose.

Emptying of Surface Gulleys.—Street gulleys, if they are to serve their purpose, should be frequently emptied. In towns where asphalt and wood pavements are cleaned by means of hose pipes the gulleys should be emptied previous to the cleansing operations, in order that as much solid matter may be intercepted by them as possible. They should also be emptied immediately after the cleaning has been finished, in order that they may stand empty in the event of rain occurring. In many towns a gulley cleaner is attached to the night staff, whose sole work is to attend to them.

In Tottenham a number of storm overflows have recently been fixed in connection with the gulleys in positions where large volumes of water pour down the channels during heavy thunder-storms. These materially assist in getting rid of the water quickly, while they also provide an outlet for the water when the gulley gratings become choked. There is considerable liability of this occurring in the outlying residential districts, where, especially during the autumn months, the leaves of trees are likely to form an obstruction. The gulleys should be refilled with clean water to which a little disinfectant has been added after each time of emptying.

Removal of Snow.—In large towns this forms one of the most difficult branches of the work which the cleansing department is called upon to perform, since no estimate can be made of the amount which will have to be dealt with, and often the work of removal will have to be performed several times over in the course of a few hours. In some instances there may be special facilities for snow removal, as in the case of seaside towns and those situated on rivers, where the snow is generally disposed of by being tipped either into the sea or the river, as the case may be. Then again, in the case of seaside towns salt water is often available for swilling down the roads. This can only be done, of course, when there is no frost. The most important consideration when dealing with snow is that the system of removal should be so thoroughly organized that when the time comes to act each man may know exactly what is required of him. The question of snow removal has been so thoroughly dealt with in a paper read by Mr. Arthur May, cleansing superintendent of Finsbury, in 1907, before the Institute of Cleansing Superintendents, that one cannot do better than to briefly outline his system.

His plan has been to divide his district up into sections, with a working ganger in charge of each. Over several of these gangers there is a foreman, over several foremen an inspector, and the whole staff is under Mr. May's personal supervision. Each ganger has a printed card showing the streets he will work upon. A similar copy is given to the foremen and inspectors, while a copy is also retained in the office for making up wages, etc. On the back of each card are written the names of the men employed in the gang. A gang may consist of from twelve to twenty men, but in no case is a gang sent out without having a fair proportion of regular employes to work with it. Every gang thus sent out has on its list a portion of a main road whereon to start work, and consequently when the gangs are all out the main roads of the borough are being dealt with simultaneously. On each list likewise there is a section of the by-turnings so arranged that where the men finish on the main roads they will commence their work on these streets. An endeavor is always made to provide sufficient gangs, so that the roads may be well under control within twelve hours of a downfall. Every employe of the council is warned to report himself at the depots for work immediately a fall of snow occurs, and casual labor is employed in addition.

The first step, the moment it begins to snow, is to load the necessary number of vans with salt, a stock of which is always kept on hand. Three men are sent out with each van, and in less than two hours it is possible to have the whole of the district thoroughly salted down, footways and carriageways. The sooner this is distributed the better, as any fresh snow falling will break up as soon as it comes in contact with the salt. After allowing the salt a reasonable time to act, a personal inspection of the district is made to note its conditions. This is important so as to avoid sending out large bodies of men with tools, etc., that may be useless, and will require to be changed, which would mean a great loss of time at the beginning of operations.

The first duty of the sweepers is to get all the snow well into the roads,

clear all channels and gulleys, and then to churn over the mixture of salt and snow. As soon as the snow has been converted into slush by this process, the flushing gangs are dispatched with all available water vans and machine brooms, and the slush is swept or flushed into the sewers as soon as possible. The amount of salt generally required is about one ton for every three-quarters mile of street. It will be noticed fhat no carting is done under this system.

A very similar system of snow removal to that outlined above is adopted at Liverpool.

In Bolton the system of carting away the snow is adopted, as only clean snow can be put into the river. The difficulty of getting rid of the snow is increasing each year, as tips and vacant plots of land upon which it can be deposited are becoming more scarce, so that the bulk has, in many instances, to be carted long distances. At one of the depots a snow melter is in use which is able to melt fresh fallen snow at the rate of a load aminute.

A somewhat different method of dealing with snow has been prepared for the borough of Paddington by Mr. H. W. Sawyer, the cleansing superintendent. If a fall of snow should occur in the night, the depot watchmen proceed at 3 a. m. to call certain of the regular employes whose duty it is to call others, so that in a short time each regular employe will have been called and must report himself for duty by 4:15 a. m. at his particular depot. The employes are divided into 82 gangs, from two to three regular men being attached to each gang, and the rest made up of casual labor. The best of the regular men act as gangers, and they are made acquainted with their work beforehand, each being given a sheet of instructions and a list of the streets to be attended to by his gang. The streets are divided into three classes, viz., primary, secondary and tertiary, which are cleared in the order given, so that the whole of the staff are first set to work on the principal streets. Their duty is to clear the footways, crossings and channels, and to make gaps in the ridges of snow left at the roadsides by the passage of the snow plows. The gangs are grouped together with from seven to ten gangs in a group, each supervised by a special foreman.

The roads also receive attention from the horse staff. Five routes have been prepared of the streets in order of importance, as far as can be done consistently with efficiency, and each route is in the charge of a foreman whose duty it is to make and maintain a clear passage for two lines of traffic. To do this he has a snow plow, drawn by six horses, and several road-sweeping and scraping machines. Salt is not allowed to be used without special instructions. No more carting is done than is necessary to clear the main thoroughfares in front of shops, or where it is likely to be an annoyance; and in residential streets it is allowed to remain at the sides of the roads while in a tolerably clean condition. Thus, should a thaw set in a considerable expenditure in cartage and subsequent disposal is saved. The snow that is removed from the highways is shot into the sewers through manholes situated in various parts of the borough.

RELATIVE COST OF MUNICIPAL WORK DONE BY DAY LABOR AND BY CONTRACT.*

By Harrison P. Eddy, Consulting Engineer, Boston, Mass.

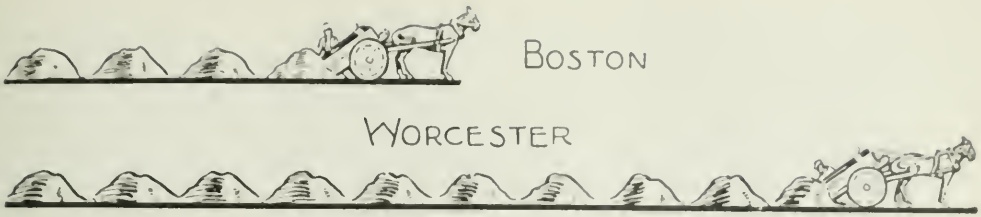
AMONG the various lines of investigation carried out by the late Boston Finance Commission were several which threw considerable light upon the relative efficiency of the contract and day-labor systems and some of the causes of the inefficiency of the day-labor forces of the city of Boston.

An effort was made to ascertain as nearly as possible the actual facts in all cases, and to reduce the conditions to figures, thus eliminating opinions.

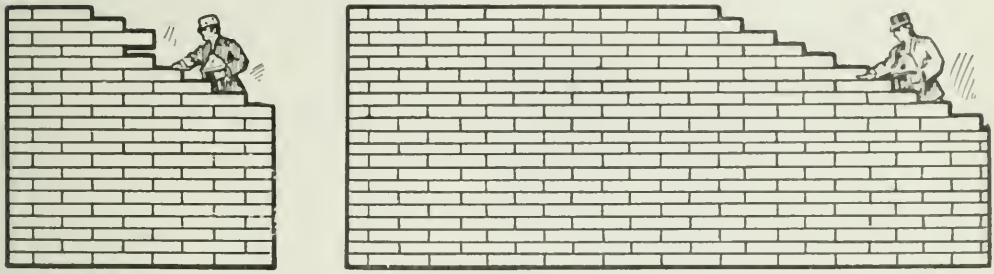
The results of these investigations are, therefore interesting and important, as showing the results of conditions surrounding city departments, and not as exploiting theories of ideal conditions which are rarely found in any city.

While most of the data refer to the

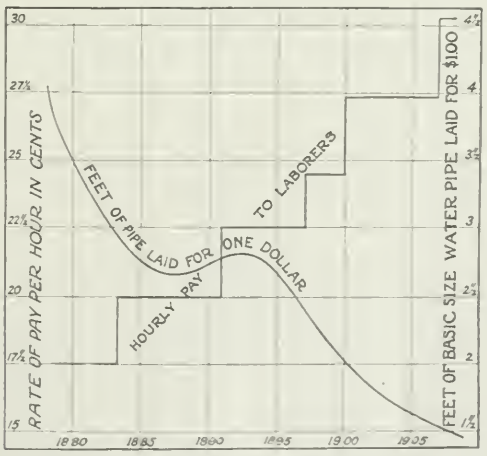
*From a paper before the American Association for the Advancement of Science.



A Day's Work in Teaming in Boston and in Worcester.



A Day's Work in Bricklaying—City Day Labor, 240 Bricks an Hour; Metropolitan Water-Board Contract, 570 Bricks an Hour.



Increase of Pay and Decrease of Efficiency of Labor in Laying Water Pipe in Boston.

city of Boston, it is believed that the lessons drawn from them are typical, and that similar results would be obtained from like investigations in many other cities.

In order to ascertain the general municipal practice throughout the country in building water works and sewerage systems, a postal card inquiry was sent to all cities in Massachusetts, and to all cities in the country exceeding 30,000 in population, as shown by the Census Bureau in 1905. The results of this inquiry appear in table 1. The questions were so worded as to apply only to ordinary extensions, and it is probable that in same cases work upon new systems may have been done by contract, while ordinary extensions were made by day-labor.

Postals were sent to 154 cities, and replies relating to sewerage systems were received from 73 cities, and relating to water works extensions from 58 cities.

Of the 73 cities making replies to the inquiries relating to sewerage systems, 52, or 71 per cent., were found to be doing this class of work wholly by contract. Of the cities located outside of New England, 94 per cent. were found to be doing their work by contract, while but 67 per cent. of the cities in New England outside of Massachusetts were using this system, and in Massachusetts only 6 per cent. The prevalence of the day-labor system in Massachusetts is very strikingly shown by these figures, which, it should be noted, are based upon replies from all of the 18 cities to which inquiries were sent. Putting it in another way, of the 18 cities in Massachusetts, 1 was doing its sewer work wholly by contract, while 17 were doing similar work wholly by day labor.

Replies to the inquiries relating to water works extensions were received from 58 cities, and if this number 33 per cent. were found to be doing the work wholly by contract. Outside of New Engiand 48 per cent. of the cities have adopted the contract system, while in Massachusetts of the 15 cities making reply to the inquiries all were found to be doing the work by day labor. The results of the inquiries relating to water pipe extensions are very similar to those relating to sewer construction, and both show very clearly that the day-labor system is very widely adopted in Massachusetts, and much more prevalent in that State and in New England than throughout the remainder of the country.

A comparison was made of the cost of building sewers in cities where work was known to be done by day-labor with that in other cities where similar work is done by contract. These com-

TABLE 1.

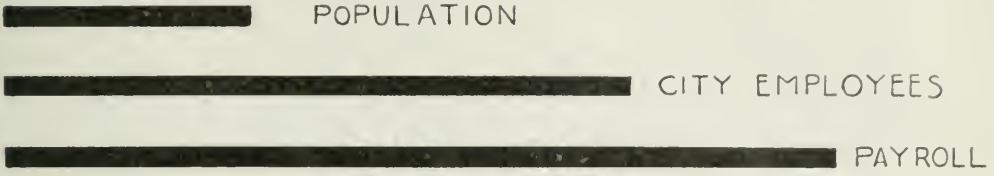
RELATIVE PREVALENCE OF CONTRACT AND DAY-LABOR IN AMERICAN CITIES OF POPULATIONS EXCEEDING 30,000 (not including Boston).

Population.	Number of Cities of Specified Size (1905 Census Estimate).	Number of Cities Enumerated.	Cities Doing Work Wholly by Contract.	Cities Doing Work Wholly by Day Labor.	Per Cent. of Cities Doing Work by Contract.
SEWER CONSTRUCTION.					
50,000-100,000	47	22	15	7	68
30,000- 50,000	67	31	20	11	65
100,000-150,000	14	8	5	3	63
150,000-200,000	6	2	2	—	100
Over 200,000	20	10	10	—	100
Totals	154	73	52	21	71
Outside of New England	126	51	48	3	94
New England, excepting Massachusetts	10	6	4	2	67
Massachusetts	18	18	1	17	6
WATER PIPE LAYING.					
30,000- 50,000	67	26	9	17	34.6
50,000-100,000	47	15	5	10	33.3
100,000-150,000	14	6	1	5	16.7
150,000-200,000	6	2	..	2	....
Over 200,000	20	9	4	5	44.4
Totals	154	58	19	39	33.0
Outside of New England	126	40	19	21	48.0
New England, excepting Massachusetts	10	3	..	3	....
Massachusetts	18	15	..	15	....

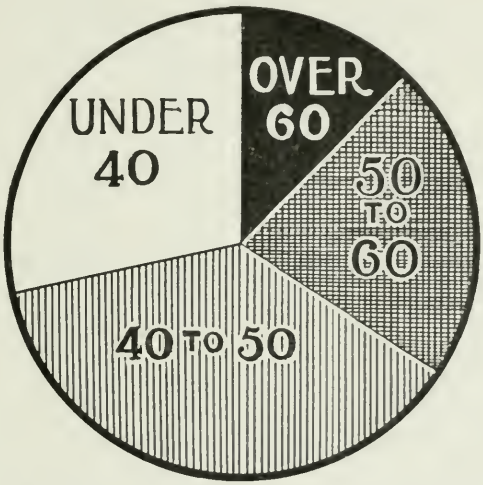
parisons were confined to New England cities, and very largely to cities in Massachusetts.

To make this investigation less difficult and reduce the element of uncertainty as much as possible, the inquiry was confined to small pipe sewers from

ing work done under comparable conditions was fully realized, and as such selection could only be made by engineers familiar with local conditions, an assistant was sent from place to place to interview the local engineers, who always very kindly, and at times



Relative Increases from 1895 to 1907.



High Percentage of Old Men Among Boston Sewer Laborers One Cause of Inefficiency.

The Votes of City Employes May Govern the Situation.

8 inches to 12 inches in diameter. Since most sewers of this class built in Boston have been constructed under contracts (largely "gift" or non-competitive contracts), the number available for comparison was smaller than was desired. As the difficulty in select-

at considerable inconvenience to themselves, carefully considered the conditions surrounding a large number of pieces of work, and advised which should be selected for use in this comparison. The number of sewers selected in each city was small, but included

all which could be classed as being built under conditions enabling fair comparison within the last few years. While it is realized that this study may be criticised as being based upon fragmentary and possibly insufficient data, it is presented as comprising the best data which could be obtained after a long and earnest effort to get at the truth. Unfortunately, in no city except Boston was this class of work found to be done both by day-labor and by contract, so that comparisons between the two methods in the same city were impossible, with the single exception noted.

These investigations were made in 17 cities, 13 of which do their work by day-labor (including Boston, which does part of its work by day-labor and part by contract), and 5 (including Boston) which do the work by contract. The average cost of building 12-inch sewers in 12 cities was found to be $2.17 per linear foot, while in the city of Boston similar work appeared to cost $5.20 per linear foot. Like work done by contract was found to cost on the average $1.82 in 4 cities, while in Boston it cost $2.35. The average cost of labor and teaming in cities, exclusive of Boston, where the work was done by day-labor, was $1.34 per linear foot, while in the four cities doing work by contract this cost averaged $0.75 per linear foot. The cost in Boston by day-labor was $3.50 per linear foot, while upon work done by contract it was $1.05 per foot, a reduction of 70 per cent.

In tables 3 and 4 the cost of labor upon small sewers built by day-labor

TABLE 2.

AVERAGE TOTAL COST PER FOOT OF COMPARABLE 12-INCH SEWERS LAID 10 FEET DEEP, IN VARIOUS CITIES.

"A" BUILT BY DAY LABOR.

City or Town.	Prevailing Diameter of Sewer (Inches).	Actual Total Cost Per Foot.	Total Cost of Equivalent 12-inch Sewer Without Allowance for Difference in Wages.	Subdivision of Cost Into: Labor and Teaming Only.	Materials and Sundries.	Engineering.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Brockton	8-inch	$1.73	$1.96	$1.20	$0.68	$0.08
Cambridge	8-inch	2.35	2.58	1.70	0.81	0.07
Everett	8-inch	2.09	2.32	1.55	0.68	0.09
Fitchburg	12-inch	1.80	1.80*a*	0.95	0.77	0.08*a*
Haverhill	10-inch	1.68	1.80*a*	0.90	0.82	0.08*a*
Lawrence	10-inch	2.38	2.50*a*	1.80	0.62	0.08*a*
Lowell	10-inch	2.30	3.42	2.35	0.98	0.09
Medford	8-inch	1.80	2.03	1.05	0.92	0.06
New Bedford	10-inch	1.88	2.00	1.30	0.67	0.03
Newton	8-inch	1.65	1.88	1.05	0.73	0.10
Quincy	8-inch	1.54	1.77	1.00	0.68	0.09
Worcester	10-inch	2.00	2.00*b*	1.20	0.70	0.10
Average			$2.17	$1.34	$0.75	$0.08
Boston	12-inch	$5.20*d*	$5.20	$3.50*c*	$1.55	$0.15

*a*Engineering estimated $0.08 per ft.
*b*Exclusive of office and shop charges, as in other cities.
*c*Owing to the fact that this figure is based upon a comparatively small number of examples, it should be used with caution.
*d*Not including proportion of undivided construction cost, which amounts to about 5 per cent. of total construction cost.

"B" BUILT BY CONTRACT.

Brookline	8-inch	$1.73	$1.95	$0.80	$0.80	$0.25*
Portland	10-inch	1.50	1.62	0.65	0.81	0.16*
Providence	12-inch	1.68	1.68	0.65	0.83	0.20*
Somerville	8-inch	1.75	2.05	0.90	0.91	0.24*
Average			$1.82	$0.75	$0.86	$0.21
Boston	12-inch	$2.35	$2.35	$1.05**	$0.90	$0.40

*Engineering and inspection.
**Advertised contracts only.

NOTE: That no correction has been applied no account of difference in wages.
NOTE: That the day-labor cost shown in column 4 includes labor on manholes, whereas the contract labor does not include this, but does include loss on sheeting, which substantially offsets it.

TABLE 3.

COST OF LABOR, TEAMING AND ENGINEERING UPON SMALL SEWERS BUILT BY DAY LABOR.

LABOR COSTS REDUCED TO UNIFORM BASIS OF $0.315 PER HOUR, AS PAID IN BOSTON
DATA REDUCED TO UNIFORM BASIS OF 12-INCH PIPE LAID 10 FEET DEEP.

City or Town.	Cost of Labor per Foot, Including Teaming, Excluding Office and Shop Charges.	Nominal Wage per Day of Eight Hours.	Actual Net Rate of Wage per Hour for Common Labor.	Cost per Foot of Labor Reduced to Comparable Basis (Rate $0.315 per Hour).	Cost of Teaming per Foot.	Cost of Engineering per Foot.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Brockton	$1.20	$2.25	$0.281	$1.34	$0.03*	$0.08
Cambridge	1.70	2.60	0.267	2.01	0.06	0.07
Everett	1.55	2.00	0.261	1.87	.....	0.09
Fitchburg	0.95	1.75	0.220	1.36	.....	.....
Haverhill	0.90	2.00	0.250	1.13	.....	.....
Lawrence	1.80	2.00	0.250	2.27	.....	.....
Lowell	2.35	2.00	0.250	2.96	.....	0.09
Medford	1.05	2.00	0.250	1.32	.....	0.06
New Bedford	1.30	2.00	0.250	1.64	0.04	0.03
Newton	1.05	1.75	0.219	1.51	0.06	0.10
Quincy	1.00	1.75	0.219	1.44	.....	0.09
Worcester	1.20	1.85	0.231	1.63	0.11	0.10
Average			$0.246	$1.79	$0.06	$0.08
Boston	$3.50**	$2.25	$0.315	$3.50**	$0.50	$0.15a

a Estimate.
*Contract teaming only; department has one horse and wagon.
**Net, including proportion of undivided construction expenses, which amount to about 5 per cent. of total construction cost. Furthermore, owing to the fact that this figure is based upon a comparatively small number of groups, it should be used with caution.

TABLE 4.

COST OF LABOR, TEAMING AND ENGINEERING UPON SMALL SEWERS BUILT BY CONTRACT.

LABOR COSTS REDUCED TO UNIFORM BASIS OF $0.315 PER HOUR, AS PAID IN BOSTON.
DATA REDUCED TO A UNIFORM BASIS OF 12-INCH PIPE LAID 10 FEET DEEP.

City or Town,	Cost per Foot for Labor and Teaming.*	Corresponding Rate Wages of per Hour.	Cost of Labor a Reduced to a Comparable Basis (Rate of Wage $0.315 per Hour).	Cost of Engineering and Inspection.
(1)	(2)	(3)	(4)	(5)
Brookline	$0.80	$0.22	$1.15	$0.25
Portland	0.65	0.20	1.02	0.16
Providence	0.65	0.17	1.20	0.20
Somerville	0.90	0.22	1.29	0.24
Average	$0.75	$0.20	$1.17	$0.21
Boston**	$1.05	$0.25	$1.32	$0.40

*Exclusive of labor in manholes, but including loss on sheeting. It is estimated that these two items substantially balance each other, so that the figures are directly comparable with the day-labor figures of Table 3.
a It should be noted that contractors in Boston usually pay but $0.25 per hour for labor unless required to pay higher wages by the city.
**Advertised contracts only.

and by contract has been tabulated after being reduced to a uniform basis of wages of $0.315 per hour, the rate paid in Boston.

Reduced to this basis, it appears that the cost of sewers built by day-labor (not including Boston) averaged for labor $1.79 per linear foot, while in the cities doing work by contract (excluding Boston) the average cost of labor was $1.17. Treating in the same manner similar work done in Boston by day-labor and by contract, it is found that the labor cost was $3.50 and $1.32 per linear foot, respectively. It therefore appears that had the rate of wages been uniform in all cities the labor cost of the work done by contract would have been 35 per cent. less than the labor cost of that done by day-labor, not including Boston in this comparison. Comparing the work done by both methods in the city of Boston, it appears that had the work done by day-labor been done by advertised contract, the reduction in the cost of labor would have amounted to over 62 per cent.

An effort was made to ascertain the prevailing rate of wages paid by contractors in the vicinity of Boston for work similar to that performed by the city water and sewer departments. Data were obtained from 35 different contractors.

The minimum rate of wages paid in this vicinity appears to be $0.15 per hour, and the maximum did not exceed in any case $0.30 per hour. Comparatively few laborers are employed at rates of pay exceeding $0.25 per hour, while large numbers are paid as low as $0.20. In general, it may be stated that English-speaking laborers are paid more than others, and further, that the rate of $0.30 applies quite generally to building laborers or to laborers who possess rather more than average skill. In no case was it found that laborers were paid for legal holidays, and only in two instances were Saturday afternoons allowed. None of the contractors gave Saturday afternoons off with continued pay, and in no case were laborers paid in event of absence from work on account of injuries received.

The contractors furnishing data do not "carry" their employes through the winter unless they have work which must be done. In other words, they do not "find" work for their laborers during the winter season as do the city departments, and consequently they do not give continuous employment.

Inquiries were sent to sewer departments of all the cities in Massachusetts, and several of the larger cities of the other New England States, to ascertain the length of day and the rate of wages in force upon municipal sewer work in the city departments. The data thus collected are compiled in table 5. Several of the cities included in this inquiry performed their construction work by contract, so that the figures given in those cases apply only to the maintenance forces. From these data it appears that the prevailing length of day is 8 hours, although in some cases a 9-hour day is required. Excluding Boston, the nominal rate of pay varies from $0.17 to $0.287 per hour, while the prevailing rate of pay may fairly be said to not exceed $0.25 per hour. In about one-third of the cities the laborers are permitted to have half holidays on Saturday, although in about one-half of these cases the half holidays are restricted to the summer months. In several of the cities where half holidays are granted the length of day is so arranged that the laborers work 48 hours during the week. In 5 cities granting Saturday half holidays laborers are paid in full for Saturdays during the summer months (varying from two to six months).

From a comparison of the wages paid by contractors and by municipalities, it is evident that city laborers are paid considerably more than laborers employed by contractors and that they work fewer hours per week. It is difficult to determine the relation existing between high wages and the efficiency of the employes. It is doubtless true, however, that higher wages are paid by municipalities very largely because of political influence.

In this connection it is very interesting to note the increase in wages paid for common labor in the city of Boston from 1878 to 1907. From 1878 to 1883 the wages paid were $1.75, and the length of the day was 10 hours. In 1883 the rate of wages was increased to $2 per day. In 1891 the length of day was reduced to 9 hours, and in 1897 Saturday half holidays were allowed with pay. In 1900 the 8-hour day was granted, together with the continuance of the Saturday half holiday, and in 1907 with the same hours the rate of wages was increased to $2.25. It therefore appears that between 1878 and 1907 the rate of wages had increased from $1.75 to $2.25 per day, or 28 per cent., and the hours of work had been reduced 26 2-3 per cent. The result of reducing the length of day and

TABLE 5.

STATISTICS CONCERNING THE DAY-LABOR FORCES OF THE SEWER DEPARTMENTS OF VARIOUS CITIES.

City.	Number of Laborers.	Length of Day.	Rate of Pay Nominal (per Hour) Cents.	Rate of Pay Actual (per Hour) Cents.	Saturday Half-Holidays Allowed.	Pay for Saturday Half-Holidays.	Allowance for Sick Leave.
Lynn, Mass.....	101	8	28 1/8	28.7	May-Oct.	Yes	None*a*
Haverhill, Mass....	...	9	28 1/8	28.7	June-Sept.	Yes	None*c*
Fall River, Mass...	178	8½	28 1/8	28 1/8	Yes	..**	None
Brockton, Mass.....	178	8½	28 1/8	28 1/8	No	..	None*d*
*New Haven, Conn..	...	9	27 7/9	27 7/9	No	..	None
Cambridge, Mass...	21	8	25	26.1	May-Nov.	Yes	None*a*
Springfield, Mass...78—153		8	25	25 1/2	Work 7 hrs.	Yes	None*c*
Chicopee, Mass.....	...	8	25	25	No	..	None*a*
Holyoke, Mass.....	...	8	25	25	Yes	..	*a*
Lawrence, Mass....	114	8	25	25	Yes	..**	Half pay
Lowell, Mass.....	...	8	25	25	In summer	..**	None
Marlboro, Mass.....	...	8	25	25	No	..	None
Medford, Mass.....	...	8	25	25	No	..	None
New Bedford, Mass.	86	8½	25	25	Yes	..**	None
Newport, R. I.....	...	8	25	25	No	..	None*a*
Waltham, Mass.....	...	8	25	25	No	..	None
Newburyport, Mass.	5	8	25	25	No	..	None*c*
Quincy, Mass.....	...	8	23 1/8	23 1/8	No	..	None*d*
Worcester, Mass...	168	8	23 1/8	23 1/8	No	..	None
*Hartford, Conn.....	...	9	22 2/9	22 2/9	No	..	None
Waterbury, Conn...	14	9	22 2/9	22 2/9	No	..	None*c*
Bangor, Me.....	4	9	22 2/9	22 2/9	No	..	None
Fitchburg, Mass....	...	8	22	22	No	..	Full pay*b*
*Albany, N. Y.....	...	8	21 8/9	21 8/9	No	..	None
North Adams, Mass.	28	8	21 8/9	21 8/9	No	..	None*c*
Newton, Mass.....	75	8	21 8/9	21 8/9	No	..	None
Concord, N. H.....	...	9	19 4/9	19 4/9	No	..	None*a*
*Portland, Me.....	...	9	19 4/9	19 4/9	No	..	None*d*
Hudson, N. Y.....	...	8	18 3/4	18 3/4	No	..	Full pay
*Providence, R. I...	84	9	17	17.2	July-Aug.	Yes	None*c*
New London, Conn.	40	9	18 2/3	16 2/3	No	..	None*c*
*Somerville, Mass...	8—15	8	..	..	In summer	..	None
Boston, Mass.....	2,000	8	30 3/4	31 1/2	Yes	Yes	Full pay*c*

*Maintenance only; construction by contract.
*a*In case of injury, submitted to a committee.
*b*Full pay may be allowed not to exceed 60 days, when approved by mayor.
*c*Full pay if injured on work.
*d*Unless injured on work.
**Work 48 hours per week, but time divided so that Saturday is a half-holiday.

increasing the rate of pay is made more apparent by comparing the rate of compensation per hour as in table 6.

TABLE 6.

WAGES OF LABORERS EMPLOYED BY CITY OF BOSTON.

NOMINAL TIME WORKED AND WAGES PAID.

Period.	Hours per Week.	Nominal Rate of Wages. Per Day.	Per Hour.
1878-1883 ...	60	$1.75	17½c
1883-1891 ...	60	2.00	20c
1891-1897 ...	54	2.00	22½c
1897-1900 ...	50	2.00	24c
1900-1907 ...	44	2.00	27½c
1907-date ...	44	2.25	*31½c

*Allowance made for legal holidays for which full pay is allowed.

From this tabulation it appears that the hourly wage, making due allowance for the Saturday afternoons and holidays, has increased from $0.175 to $0.315, an increase of 80 per cent. in the cost to the city for the work done, assuming equal efficiency. In this connection is should be noted that while the cost of labor to the city has increased 80 per cent. per hour, the increase in daily wages received by employes has amounted to but 28 per cent.

It is further important to note that while the cost per hour to the city for labor has increased 80 per cent., the efficiency of labor, as already shown, has fallen 50 per cent. In other words, a dollar's worth of time in 1878 would to-day cost the city $1.80, but the efficiency having dropped 50 per cent., the city is obliged to pay $3.60 for the amount of work done in 1878 for $1, an increase of 360 per cent.

It would not seem unreasonable to expect that some relation may exist between the rate of wages paid and the efficiency of labor—or, in other words, that enough work would be done per hour under the higher wages and

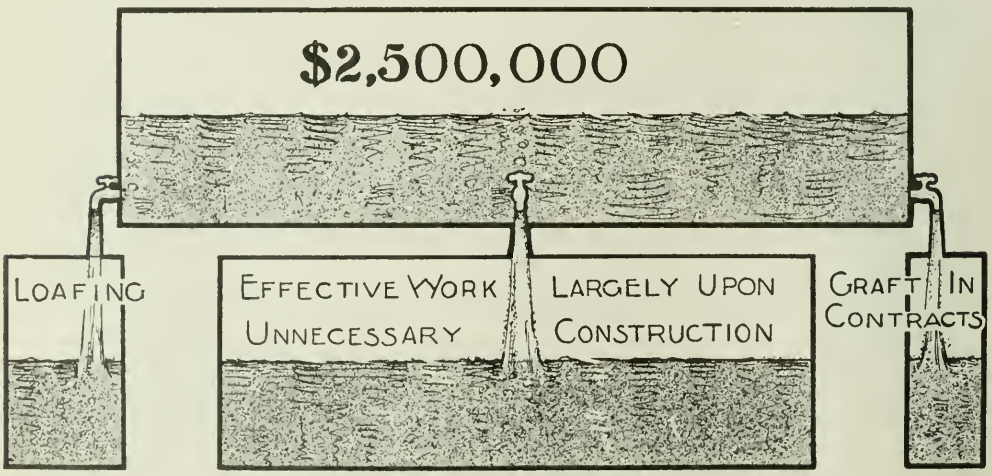
shorter hours, so that at least as many feet of sewer would be laid for $1 as in cases where lower rates of wages prevailed. The following tabulation made up from table 3 shows the number of feet of sewer laid for $1 when the wages are reduced to a uniform basis of calculation. The percentage of efficiency is calculated on the assumption that the Brockton labor was 100 per cent. efficient.

	Rate of Wages Actually Paid.		Number of Feet of Sewer Laid for $1, Figured on Uniform Basis.	Per Cent. Efficiency, Assuming 100% Efficiency in the One Case when Wages Equals $0.821.
	Per Day.	Per Hour.		
Brockton	$2.25	$0.281	0.746	100.0
Seven Cities.....	2.00	0.254	0.529	70.9
Worcester	1.85	0.231	0.613	82.1
Three Cities.....	1.75	0.219	0.694	93.0
Boston	2.25	0.315	0.286	38.3

While it may not be fair to draw the conclusion from these figures that labor is less efficient because of higher wages, it does seem to follow that higher compensation does not assure greater efficiency. The greatest efficiency was apparently obtained in the case of the city of Brockton, where the nominal wage is $2.25 per day, although in Boston, where the same nominal wage is paid and holidays granted in sufficient number to increase the rate per hour over 12 per cent., the lowest efficiency was indicated. Averaging the results obtained in cities paying the same rate of wages, there appears to be a gradual decrease in efficiency as the rate of pay increases.

While the difficulties of such investigations are many, it is believed that the results recorded represent very conservatively the conditions existing. It is apparent that municipal work done by day labor is in general, under the conditions of to-day, much more expensive than similar work done under the same conditions by contract. It is also apparent that the labor force in city departments where work is done by the day-labor system is very inefficient as compared with similar forces employed by contractors, and has, during the last ten or fifteen years, decreased greatly in efficiency, at least in the city of Boston.

There are many causes of the excessive cost of day-labor work and of the inefficiency of the day-labor forces, all of which may be grouped under the one great evil—the entrance of politics into municipal business. These causes include abnormal rates of pay, the granting of holidays and half holidays, the employment of aged and physically incompetent laborers, absence of discipline, a lack of incentive, and the inexperience of those in executive positions. It would further appear that the number of men growing old in the



Distribution of Appropriations in Boston Water and Sewer Departments.

service of the city, who were at the time of their original employment young and vigorous, is not a material cause of inefficiency. On the other hand, the employment of men in city departments who have passed their years of usefulness in the service of other parties has a demoralizing effect upon the labor forces, and has undoubtedly been the cause of much of the inefficiency noted in municipal day-labor forces.

BITUMINOUS HIGHWAY CONSTRUCTION.*

By Clarence A. Kenyon, Indianapolis, Ind.

IT is now settled beyond question that gravel and macadam roadways, no matter how well constructed, are not adequate to sustain anything but light automobile traffic (the Massachusetts Highway Commission says 100 vehicles per day), and all sorts of efforts have been made and are every day being made to overcome the known defects of the macadam roadway when subjected to modern methods of travel.

In the efforts which have been made to do so, many kinds of oils, plain and emulsified, various tar compounds and asphalts, liquid and otherwise, chemical compounds many and various, some merely poured, sprinkled or sprayed on the roadway; some mixed with cold stone, sand or gravel; some poured or mixed while hot, and some with the road metal and the bituminous material both hot and thoroughly mixed and compacted. Some of these materials and processes have met with more or less success, as they have approximated or departed from correct principles of road construction.

Europe is forging ahead. (In one section contracts for 70 miles of bituminous roadways were let last season.) Rhode Island and New Jersey have definitely decided not to construct any more merely macadam or gravel highways.

To be sure, the knowledge is common that the standard modern city pavements would be entirely adequate to meet the conditions, but the cost of construction of these pavements has in most instances practically prohibited their use for country highways. Even in the face of the cost there has been much urgent demand for paved highways. Brick, bitulithic and asphalt have, in some instances, been laid.

Let us review in a general way what has been done by experimenters in various ways.

1. Dust Layers.

Under this head may be included various chemical compounds, patented and otherwise, such as carbide, salts of various kinds, crude oils, heavy and light; so-called asphalt oils, emulsions, light tars, tar oils, light and heavy, and creosote oil. The methods of use of these various products differ, but as a rule they are sprinkled or sprayed (some cold, some hot) on the surface of existing roads, for the purpose of laying the dust, or rather preventing its rising.

The results may be generally summarized as follows: The oils mingle with the particles of dust and prevent their flying in the air, by a whirl of air or wheels. The tars spread a thin film over the surface where it is hard, and prevent the dust from flying; and the carbides and other solutions make wet the dust, and so keep it down; but in each and all of these experiments the result is only for a few months at most, except under extraordinary conditions. The treatment has to be renewed frequently, and is never permanent. In France the engineers, and shortly after the public, generally pronounced these results ineffective, except at considerable cost, and declared that the experiments demonstrated that no noticeable strength was added to the macadam or gravel surface.

In England the "Ballymeagh Trophy," value $500, was offered as a prize. Nineteen compounds competed. Each was laid for an equal distance, contiguously, on one of the main roads in Middlesex, and examinations were made semi-monthly by a committee of expert road engineers. R. S. Clare & Co., of Liverpool, were awarded the trophy on a tar compound, laid hot by spraying, but even that wore off in a few months and had to be renewed.

*A Paper before the Indiana Engineering Society.

None of these oils, light or heavy, or light tars were regarded as of any permanent value as a "binder" or cementing material for road construction.

In this country, in some localities, somewhat better results have obtained, especially where the heavy oils with asphaltic bases have been used, and the road itself was well constructed and the traffic light. In some cases where the roads were frequently oiled the light constituents gradually evaporated, and the heavy oil united with the sand and stone dust of the road and "caked" on the surfaces and gave the impression of a paved roadway. Capitol avenue in Indianapolis is a fair example of this. I believe the top surface was originally mixed with an emulsified asphaltic oil in a mixer and laid and rolled. The street has been oiled with the best grade of heavy oil two or three times each year for several years. The street is a boulevard, and all heavy traffic is prohibited. It has to be repaired every year.

The city engineer of Los Angeles, Cal., declared in a public report that after several years' experience they had found that as a pavement-maker the asphaltic oils even were a failure, and did not justify the hope that was formerly entertained for them.

It is to be regretted that some of the sellers of road oils have confused many people by claiming that some of these heavy oils were asphalt binders, cements, etc., instead of dust layers.

The cost of applying these various "dust layers" has been tempting—from 2 cents to 10 cents per square yard for each treatment. The price has been sufficiently attractive to tempt many well-meaning people to more than half believe the lurid statements and "fine" photographs of the promoters.

2. Binders.

By this is meant some form of bituminous material that will bind or cement the particles of road metal (sand, gravel or stone) together. These cements are usually made from (1) natural asphalt, fluxed to a standard degree of consistency, (2) pitch, made from coal gas tar, to a standard degree of consistency.

Efforts are constantly being made to mix a small percentage of asphalt with a large percentage of heavy petroleum oil, or oxidized oil (and it can be oxidized so as to be as hard as asphalt or pitch), and call the resultant product "bituminous cement" or "binder" for road materials. Some agents even go so far as to claim that the material is 88 per cent. asphalt, etc., and the question is often asked, how is the engineer or public official to prove to the contrary? Eighty-eight per cent. will dissolved in carbon disulphide, and the chemists do not deny it, etc.

The writer believes that it is at present an accepted fact that chemical analysis is barren in its efforts to tell the physical qualities of these bituminous substances. Most of them are hydro-carbons, and the chemical anaiyses of certain gases and of pure asphalt are the same. These substances, at least many of them, are what are known as isomers, as many as 98 substances with different physical qualities, and yet in the chemist's laboratory they are all hydro-carbons with the same formula, $C_9H_{10}O_3$. It must be clear, then, that for the engineer to be reasonably sure of his ground he must (1) prescribe and use only such materials as extensive experience has proven to produce bituminous cements of effective value (even then great care must be used in the handling by expert workmen and directors), or (2) he must have a series of accurate tests to determine the physical qualities of a bituminous cement of a certain consistency, just as we have standard tests for determining the physical qualities of Portland cement, Rosendale, Louisville and other hydraulic cements.

A large number of experts are at work now trying to devise and formulate such a series of tests. Progress is being made, and I predict that in a few years tests will be standardized for bituminous cements the same as they are now for hydraulic cements. In spite of all this uncertainty, much is accurately known from experience, and the demand for bituminous pavements goes unceasingly on. A few axiomatic facts are elemental and helpful.

If a bituminous material will cling to stone, gravel or sand at the ordinary temperature of summer air, say 78 degrees F., and at the same time catch and hold small grains of mineral and dust, but will not hold by the cementing strength of the bituminous cement another stone or stones, say of ordinary road metal, from falling from it when suspended, it is safe to say it is a dust layer, if anything, and not a cement or asphaltic "binder," or in fact any kind of a "binder."

Don't mistake me. If you lay down 2-inch macadam stones and press mud between the stones, the mud seems to act as a binder, but the mud has practically no cementing quality. The mo-

ment the edge of the pavement is raveled the stones fall apart. Oil may be oxidized so hard that the result is analogous, but the cementing quality is so slight as to be of no permanent value.

Heavy petroleum oil is not a cement, and will not become a cement by pouring it on a road and waiting for the light oil to evaporate. The light oils have already been taken from it by from 500 to 600 degrees F. of heat. Nor do I believe that mixing 10 or 20 per cent. of natural asphalt with 80 to 90 per cent. of heavy oil will produce bituminous cement. A material that can be mixed cold is not likely to be cementitious.

Mixing hot bituminous cement with cold, damp stones does not produce a good result.

A bituminous material to be a binder or cement must at ordinary air temperatures actually stick to the stones with great tenacity and bind or fasten them together. The greater its tensile and compressive strength is, the better; besides, the material should not lose its strength or become brittle in cold weather, nor lose its strength and become too soft under summer heat.

The simplest and best test of road materials is their behavior under actual usage for a term of years. All of the empirical or hurry-up tests may lead you into error. The safest rule for the present seems to be to prescribe only the best of the well-known and standard cements made of asphalt or coal gas tar, carefully refined.

The next question, after having decided on a suitable bituminous cement, is the character of the construction to be adopted. While there are many forms and classes of construction that the limits of this paper prevent discussing here, they may be roughly divided into two classes:

1. The Penetration Method.
2. The Mixing Method.

In either class of construction it is assumed that the road has been suitably graded and drained, and the subfoundation properly compacted.

Upon the sub-foundation is spread the coarse stone or road metal, and rolled to the proper contour. This may be poured with heated bituminous cement, or it may be treated as a foundation. If the latter, a surfacing of from 2 to 3 inches of smaller stone, say from 1 to 2 inches in largest diameter, the smaller stones evenly distributed through the larger stones, carefully and evenly spread over the foundation and poured to the extent of about 1½ gallons of the heated bituminous cement per square yard of surface, care being taken not to form pools or fatty places. This should be carefully and thoroughly rolled and top-dressed with screenings and rolled again. If this coating of fine stone, gravel and sand be again poured, or, what is better, sprayed, while adding some to the cost, it more than makes up in value. Pouring should not be permitted while the stone is wet, or the cement not properly heated. If 50 per cent. by measure of fine hot sand is incorporated in the hot cement, just before pouring, strength is added. An even grading of the stone, a low per cent. of moisture in it, a very uniform cement, used good and hot, uniform and plenty of rolling, all add to the construction.

The Indianapolis motor speedway was paved similarly. It was not successful, and has been abandoned, and yet there were large areas of that pavement that withstood the terrific strain of those heavy automobiles going at the rate of 100 miles an hour perfectly, and would have continued to do so for an indefinite time. In the writer's opinion the faults were: (1) In many places the sub-foundation was not properly drained, and the soft places gave way. (2) The road metal foundation was not heavy enough. (3) The grading of the stone in the surface was not uniform and did not permit an even penetration of the cementing material when it was poured into the surface. (4) The cement was not uniform in consistency; some was hard, some soft, and was not uniformly heated when used. (5) Some of the work was done in inclement weather when the materials were not suitable for this form of construction.

In spite of this, some very excellent results have been obtained in the East with this form of construction, and inasmuch as the cost is quite low, it is tempting. It excludes the water, prevents dust, except from dirt carried on it, and where the traffic is moderate requires few repairs.

It is believed that if a carefully compounded fine mixture, say from ¼-inch to mineral passing a No. 100 screen, be heated and thoroughly mixed with a standard paving cement, and this mixture be spread while hot, evenly over the paved foundation, say one-half to one inch thick, and driven into it by rolling, a very excellent result would be obtained, good enough even for city streets with light traffic.

The mixing method is to heat the road metal and while it is hot thor-

oughly mix it with bituminous cement, lay it on the foundation and compress it. Various ways and means may be adopted. A few general suggestions may help.

Care should be taken to have a firm foundation. Clean, hard stone of uniform grading of sizes; stones all of one-inch would be a failure, as would stones all of three-quarters or one-half inch or smaller. The fewer voids between the stones, the greater density of the mass (obtained by grading the sizes properly) and the smaller amount of cement required. Even spreading, uniform compression, careful construction, critical inspection, make for more in bituminous construction than in any other.

The cement sticks tighter and longer to a dry, hot stone (in fact, it slightly penetrates it) than to a cold, damp one. Uniform cement, uniform heat and uniform grading of the mineral aggregate insure the same thickness of the cement over the stone or sand surface, whether the particles be large or small, and uniform penetration is secured, all of which make for more durable and stable construction.

There is no reason why on even heavily traveled roads such construction should not endure for years, and the cost of maintenance be reduced to a minimum.

The cost per ton per mile of hauling produce over roads such as I have been describing is from 3 to 5 cents, while the cost per ton per mile on ordinary country roads is from 25 to 40 cents, according to condition and season. The saving on the hauling of five tons of wheat for each mile would pay, under ordinary conditions, for the construction of a square yard of the best of the roadways described. This saving would soon pay for the road, not to speak of saving in repairs.

Remember that the cost per unit per annum is the final test of the value of any paving material.

It is throwing money away to build macadam or gravel roads under present and threatening traffic conditions, and in this dilemma all eyes are being turned to some form of bituminous construction. It seems to be the one material with which a durable roadway pavement can be constructed at reasonable cost.

CROWNS OF PAVEMENTS.*

By Geo. C. Warren, President of Warren Brothers Company, Boston, Mass.

THE writer had read with much interest an article recently read before the American Society of Civil Engineers touching on the above subject, and perhaps some thoughts which come to his mind may be of interest.

At the outset he begs to plead for a less frequent use of algebraic formulae to express simple engineering propositions which could be more clearly stated in plain English. From the excellent paper above referred to the following algebraic rule for computing street pavement surface curvatures is quoted:

"The formula is $Y = \frac{bx^2}{a^2}$, in which b is the depth of the gutter below the grade of the center of the roadway, a is the half roadway, x is the horizontal distance from the center of the roadway, and v is the vertical distance below the grade."

I believe that most of those of us who have sufficient technical education to be able from this formula to calculate the desired curvature of surface for any particular street will agree that a simple statement in plain English would be better understood by the average man if not by the technical engineer.

Given a roadway having a width of 60 feet between curbs and a height of crown above gutter of 15 inches, the formula above quoted makes the grade at the quarter (point midway between crown and gutter) 3.75 inches below the crown and 11.25 inches above the gutter. How much more simple is the following plain English rule:

The result of this rule would be: Width 60 feet between curbs, divided by 4 = 15-inch crown; 15-inch crown divided by 4 = 3.75-inch level of quarter below crown, being exactly the same as the rather complicated algebraic formula quoted above.

As stated below, the writer is of the

*From a paper before the American Society of Municipal Improvements.

opinion that a better division of the fall is one-third from crown to quarter and two-thirds from quarter to curb, which, in the case of the above 15-inch crown, would provide a fall from crown to quarter of 5 inches and from quarter to curb of 10 inches.

The following formula is quoted as employed by the late Andrew Rosewater, C. E., in his practice as engineer of the city of Omaha:

"$H = \frac{W\ (100-4P)}{5{,}000}$, in which W is the width of the roadway and P is the percentage of grade."

How much more simple is the reported formula of the engineer of the Chicago West Park Commission:

"Make the crown two (2) per cent. of the width of the roadway." (Of course, meaning width between curbs.)

Mr. Rosewater's formula quoted above is the first time the writer has seen any published rule which recognizes the common-sense principle that the greater the percentage of grade the less should be the crown. In fact, the writer's observation is that municipal engineers very seldom modify their crowns to meet the varying conditions of either steep grades, streets having car track, or different pavement surfaces. With no allowance for car tracks the prevailing custom provides a fall between track and curb—perhaps only half the width between curbs—is the same as that planned for the same width of street without tracks. The result is that, as a general rule, the crowns on steep grades and on streets having car tracks are far too great for safety of horses or automobiles.

But is Mr. Rosewater's formula correct in the ratio of allowance for steep grades? With a roadway 40 feet between curbs and 2 per cent. grade, it would figure:

$$\frac{(100-4P) \text{ or } 92\times40}{5{,}000} = .732 \text{ ft.} = 9.18 \text{ in. crown,}$$

which, in the writer's judgment, with classes of pavement providing the best foothold, is about correct.

With the same width and 6 per cent. grade, Mr. Rosewater's formula figures:

$$\frac{(400-4P) \text{ or } 92\times40}{5{,}000} = .608 \text{ ft.} = 7.3 \text{ in. crown,}$$

which, in the writer's judgment, should not exceed 4 inches with any kind of pavement on a roadway having 6 per cent. grade, 40 feet width between curbs, and no railroad tracks.

Another important point. The writer has never seen in any published formulae, and far too seldom in practice, any recognition of the common-sense principle that some forms of pavement having smooth surfaces can stand and should have less crown that other forms of pavement providing better foothold.

(Rosewater gave one formula for asphalt and similar pavements and another for brick and other pavements of like surface. See MUNICIPAL ENGINEERING, vol. xiv, p. 247.—EDITOR.)

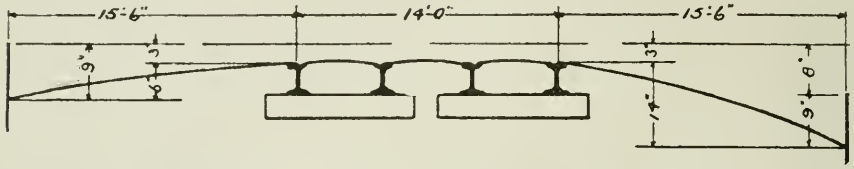
Engineers, too, are frequently, if not almost as a general rule, prone to provide that the crown shall be the same level as the top of the curb, regardless of the width of roadway or depth of gutter (exposed face of curb) required to properly carry the water to the catchbasins, with the result that many wide streets have too little crown or too great exposed face of curb (if not both errors) for either appearance or utility. The writer believes that the general tendency of engineers is to provide too flat crowns. Water is the great enemy of all forms of pavement, and unless the crown is sufficient to readily carry the water from slight depressions, which are necessarily to some extent in the surface of every pavement, the durability of that pavement is very greatly reduced.

There is no feature in pavement or roadway construction which should have more intelligent consideration of the engineer, and conversely, in the writer's experience, no feature which is given as little consideration to meet the conditions of each particular case as this matter of crown.

The following is a typical case of common error which has come to the writer's attention.

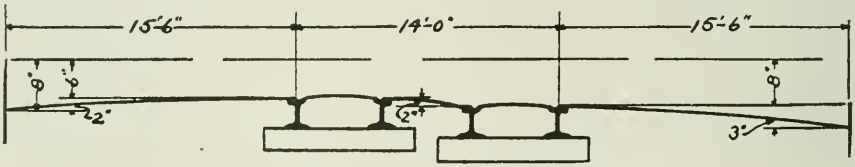
The width between curbs is about 45 feet with double track. A portion is nearly flat, and about 700 feet of the street has a continuous 8 per cent. grade. On the steep portion the top of the curb on the low side is about 8 inches higher than on the high side. With only one cross street, about the middle of the steep portion, the engineer provided 9 inches exposed face of curb to carry the water. On the flat portion he provided a desirable crown of say 6 inches, but carried the same crown up the 8 per cent. grade. The figures are from memory, but approximately correct, and illustrate the point. On the 8 per cent. grade, there-

fore, the cross-section is amout as in the first of the accompanying cuts (providing 14-inch crown on the low side in 14½ feet width between track and curb):



I. THE USUAL CROSS SECTION WITH ONE CURB LOW.

With the sidewalk and curb grades previously established, this condition provided an unusually difficult problem, especially at the intersections on the steep grade, but by providing additional catchbasins at intervals in the long steep grade, and 4-inch face of curb on the low side, and the track on the low side 2 inches below the high grade, it could have been very much improved as shown in the second cut.



II. PROPOSED IMPROVED CROSS SECTION.

This would provide 2-inch crown on the high side and 3 inches on the low side. By raising the curb and walks 1 inch to 3 inches on low side the depth of suggested gutter could be increased to from 4 inches to 6 inches.

Objection may be raised to establishing track grade on one side 2 inches lower than the track grade on the other side. The writer, however, can see no practical objection and great advantage in safety to horses and automobiles by this provision where the curb grade on one side of the street is necessarily lower than the curb on the other side. He believes that such objections as may be made are based on the novelty of such a provision, and that on calm consideration it will be seen to provide both better appearance and superior utility to the undesirably high and unsafe crown which is otherwise necessary.

At the cross street, about the middle of the 700 feet of 8 per cent. grade, the crown of the cross street was carried out to the track in the center of the street represented by the above cross-sections, with the result that from the point midway between the curb and track on the low side and the pavement surface at the low corner curb is a drop of about 24 inches in 20 feet, just at the point where horses must travel and change their footing while turning the corner from a flat to a steep grade, while the hoofs on one side are about three inches below the hoofs on the other side—a veritable horse trap—and the "pavement," not the "grade," is publicly denounced as unsafe and slippery.

The writer has adopted and recommended with good satisfaction the following general rule:

For pavements having smooth surface, such as asphalt, creosoted blocks, and grouted stone blocks and brick, and having grade of 2 per cent. or less, with no car tracks, make the crown one (1) inch to each six (6) feet width between curbs.

For pavements providing more secure foothold, such as stone blocks and bricks having bitumen filled joints, macadam or bitulithic, on streets having a two (2) per cent. or less grade, make the crown one (1) inch to each four (4) feet of wdith.

If street has car tracks, deduct the total width outside to outside of rails from the width between curbs and divide the difference (double width between track and curb) by six and four respectively.

For grades between 2 per cent. and 4 per cent. provide one-half the crown provided by the above computation.

For grades above 4 per cent. provide a crown one-third that of the above computation.

Provide one-third of the lateral fall between the crown and the quarter and two-thirds between the quarter and the curb. By "quarter" is meant the point midway between the center

of the roadway and the curb, or in the case of car-track streets, the point midway between the outside rail and the curb.

Some engineers have objected to such flat crowns on steep grades because they do not rapidly carry water to the gutter. The answer is, you cannot, in any event, on steep grades carry the water directly to the gutter, and it is better to let it run a little down the center of the street during the comparatively short periods of rainfall than to have the crown unsafe for horses at all times.

PAVEMENT MAINTENANCE ALONG STREET RAILROAD TRACKS.*

By F. V. P. Ellsworth, City Engineer, Hot Springs, Ark.

IN the smaller cities the street railroad companies are not justified in making a strictly first-class construction; that is to say, the using of 110-pound steel rail and the construction that is necessary in keeping therewith. For instance, in the city in which I live, the city of Hot Springs, Ark., we have but twelve miles of double-track street railway, and the amount of traffic over this street railway is not great enough to warrant such a heavy construction; nevertheless, those street railway tracks must be paved wherever the streets are paved.

The question arises, "What kind of construction is the most practicable?"

There is no doubt but that the T rail is the rail to use, and it should be of such weight as is best suited to the conditions.

Now, then, no matter how heavy the rail, nor how many ties or tie-rods used, nor how heavy the concrete work, nor how heavy the entire construction, there is bound to be some vibration along the rails. And in the small city with the lighter rail, using a wood tie and no tie-rods, the vibration is consequently greater and very noticeable.

Wherever there is vibration there is the resultant repair needed from time to time, and the greater the vibration the more often the repair. If the track needs repair, then the paving along said track must need repairs. Consequently, a sheet pavement is not practicable along the street railway tracks. Some kind of a block pavement must be used.

The question then arises, "What shall we do where the street on either side of the tracks is paved with a sheet pavement having a soft surface, such as asphalt, bitulithic, or other bituminous material?"

The common usage is to pave along the outside of the rails with the block used, and then pave up to it with the soft surface.

This is the easiest and cheapest method, but what about the future? What happens when those blocks are taken up in order to make track repairs? We know that the soft pavement will lose whatever bond it has on those blocks; it will also be broken in many places, especially when repairs are made in cold weather and the surface is more or less brittle. Consequently there is a rutty pavement along the street railway tracks. Who is responsible? The street railway company claim they must take up the blocks in order to make repairs, and had the street not been paved so close with the soft pavement they would not have broken it. They are not equipped to take care of the soft pavement, and should not be expected to stand the extra expense, when they are only required to go a certain distance from the rails.

The street is the sufferer, and remains in a rutty condition until it is so badly worn that the city must make large patches all along the street railway tracks and at a considerable expense.

Again, after the soft pavement has left the block there is nothing to support the block from that side or end, whichever the case may be. The bond is broken, and the block begins to tilt and rock and finally be crushed or rolled out of its bed. This calls forth still more objection by the traveling public until the proper repairs are made by both the street car company and the city at the same time.

*From a paper before the American Society of Municipal Improvements.

Something must be done, and this is a very good opening for the engineer to experiment.

I have a plan of construction which I have used, and I understand the city of New Orleans, La., has also used it with more or less success. It is the placing of a "liner" of granite, or other stone standing a strong abrasion test, along the outer edge or boundary line of the street railway company's right of way.

This liner should be dressed on top and ends and have a thickness not greater than 4 inches, and be not less than 3 feet in length, and of such depth as best suited to conditions, usually 12 to 18 inches. It should also and by all means be set on a concrete base or foundation.

At one letting of contracts for the paving of several districts under my charge I drew up specifications for a concrete liner, this liner to be entirely of concrete with the top or wearing surface to be composed of a mixture very similar to the wearing surface of the Blome granitoid pavement. I am sorry to state that when it came to the closing of the contracts the commissioners could not see why they should allow this extra expense to the cost of the pavement, and cut out the liner altogether. Therefore, I have had no experience with a concrete liner, and can not state as to its success. It seems to me that a concrete liner properly constructed with a granite wearing surface ought to give satisfaction.

There are many advantages to be gained by this liner between the two pavements. There can not be a railroad constructed with absolutely no vibration. The vibration may be reduced to almost nothing on tangents, but there will be a pound at the beginning of the curves where the cars take the same.

I have often noticed cracks in the pavement, through the top and the base, radiating from the tracks at the beginning of the curves, even where the construction is very heavy.

A liner constructed of stone curbing will prevent this to a great extent. In fact, it so distributes the pound or vibration that there is small chance for the causing of cracks in the pavement.

And should the railway tracks need repairs or even an entire change in construction, the same can be made without harming the street pavement in the least.

As to the extra cost, this is more or less a delusion, and greatly depends upon the comparative costs between the pavement and the liner. Should the finished pavement cost $2.70 per square yard of surface, and the liner in place cost 10 cents per linear foot, it is a stand-off in the total cost, because of the amount of surface that is displaced by the liner.

COMPARATIVE ROAD TESTS AT CORNELL UNIVERSITY.

THE Office of Public Roads of the U. S. Department of Agriculture at Washington and Cornell University, under the special charge of Professor W. W. Rowles, are co-operating in a series of comparative tests of various materials for and methods of construction of suburban roads. The road selected is a typical one of this class in close proximity to the university grounds. The following is mainly abstracted from Professor Rowles's report on the construction of the road.

The stone used for foundations in the test pavements is Blakeslee limestone. It was also used for wearing surface except in the brick and slag sections. Where it is used for the wearing surface, excepting the concrete section, the test is mainly of the road oils and tars used in binding the materials together and of the methods of using them.

The bituminous binders were applied first by the penetration method, wherein the material, heated to a temperature of 200 to 300 degrees F., is poured on the stone and coats it, running into the layer of stone 2 or 2½ inches; and second by the mixing method, wherein the stone, thoroughly warmed until dry, is thoroughly mixed with the bituminous binder in a concrete mixer or on a mixing board, spread on the road and rolled down. See the article on "Bituminous Highway Construction" on another page of this number of MUNICIPAL ENGINEERING for a more detailed description of the two methods.

The general length of sections is 300 feet, with slight variations as

COMPLETED TEST BRICK ROAD AT ITHACA, N. Y.

TEST BRICK ROAD AT ITHACA, N. Y.
Applying Cement Filler.

noted. The details of treament of the sections follow.

Sec. 1, 300 feet long. Macadam stone road treated with Tarvia X by the penetration method. Tarvia X is a very heavy coal tar that will scarcely flow from the barrels. The stone after application of the heated tar is rolled, a thin coat of the same is broomed on and a coat of stone screenings is applied.

Sec. 2, 300 feet long. Tarvia X was used as a binder, the mixing method of application being used. Less tar is required and every piece of stone is thoroughly coated, and after rolling the bond between stones seems to be more perfect than in the penetration method.

Sec. 3, 300 feet long, is paved with brick laid on a dry limestone base, rolled, with limestone dust binder. The concrete curbs are 20 inches deep, and are 4 inches thick where there is no traffic and 6 inches where there is. The brick were laid strictly according to the specifications of the National Paving Brick Manufacturers' Association, under the personal superintendence of Secretary W. P. Blair, of that organization. Special care was taken to have a uniform 2-inch sand cushion, to lay, roll and tamp the brick carefully, to put in an asphaltum expansion cushion next the curb, and to put in the filler of 1 part Portland cement and 1 part clean sand according to the most approved method. Five different makes of brick were used. The two accompanying photographs show the application of the filler and the completed pavement. They also show characteristic views of the road. A street railway track runs alongside the road for a part of its length, but most of it is not thus encumbered.

Sec. 4, 300 feet long, is constructed with limestone and "bitos," an oil product even heavier than Tarvia X, by the mixing method. The 4-inch bottom course was thoroughly rolled with binder. Then 2 inches of the upper course was laid down and rolled and another course of stone mixed with bitos was laid down about 2 inches thick and rolled to a firm consistency. Under this section quicksand was encountered. It was removed to a depth of 18 inches and the sub-grade was filled with stone "shucks."

Sec. 5, 300 feet long, is macadam treated with Texaco by the penetration method.

Sec. 6, 300 feet long, is macadam treated with oil prepared by the Standard Oil Co., by the penetration method.

Sec. 7, 300 feet long, is macadam, but instead of filling the coarse stone with screenings, as in the standard macadam road, two inches of Kentucky rock asphalt was spread over the surface and rolled down as far as possible into the limestone. Kentucky rock asphalt is an asphaltic sandstone, and when it is crushed and ground every particle of sand is thoroughly coated with oil. When rolled a very smooth, hard, oiled surface is formed. At first the surface showed the imprint of horses's calks and even picked up, but only temporarily. It appears now to be equally impervious to wear and water.

Sec. 8, 300 feet long, is macadam reinforced with tar prepared for road purposes by the United Gas Improvement Co. of Philadelphia, by the penetration method.

Sec. 9, 300 feet long, is macadam treated with road oil supplied by the Indian Refining Co., by the penetration method.

Sec. 10 has a wearing surface 4 inches thick of open-hearth slag from Wickwire Bros. furnaces at Cortland, N. Y. For the first 100 feet of length the road tar of the United Gas Improvement Co. was applied and formed a satisfactory binder.

For the other 200 feet of the section no rolling would bind the bare slag satisfactorily. Not wishing to use clay, which is most commonly used with slag as a binder, quick-lime was tried. This material requires some time to show its action and meantime no definite report can be made, though the indications are that lime will be a satisfactory binder.

Sec. 11 for 270 feet is of macadam with the American Asphaltum and Rubber Co.'s asphaltum binder applied by the mixing method. After the treated stone was rolled down the surface was broomed over with a thin coat of asphaltum and limestone screenings were rolled into it to give the final surface.

The last 30 feet of the section were made of concrete of 1 1-3 parts of cement, 1 part of sand and 4 parts of cinders from the university heating plant, mixed in a concrete mixer, spread and rolled with a 500-pound roller. No surfacing was given the concrete.

Sections 12, 13 and 14 are each 200 feet long. The pavement is of concrete made of cement 1 1-5 parts, sand 1 part and limestone graded in two sizes 4 parts. This concrete was 4 inches thick and was laid on the same 4-inch limestone base as most of the

other sections. A 4x4-inch scantling was used to hold the edges in place.

Sec. 12, 200 feet long, is coated with the American Asphaltum and Rubber Co.'s asphaltum, filled with limestone screenings.

Sec. 14, 130 feet long, has the uncoated concrete surface.

The pavements were not all completed, and next season four sections will be laid using the mixing method with the same materials used this year with the penetration method. One new material will be used on a fifth section by the mixing method.

The brick pavement is, of course, not an experiment, and some of the other materials may be said to have passed the experimental stage. Good opportunity is offered for comparison of the various methods and materials, and it is to be hoped that the results will be of some practical benefit.

The question of cost is an important one, but it is doubtless true that the cost of laying these various sections will be no good measure of the cost of laying the same materials in regular work. No figures of cost are given in the report of Professor Rowles, and they would be greater than usual for the same materials and methods. This item in the comparison must therefore be supplied from other sources.

POSSIBILITIES OF THE USE OF MINERAL OILS MIXED WITH CONCRETE.

By Albert Moyer, Assoc. Am. Soc. C. E., New York City.

THE mixing of oil (mineral) with concrete is very simple. The oil, alkalies and water will form an emulsion, becoming thoroughly incorporated in the concrete. If the concrete is to be mixed by hand, proceed as usual, and after the water has been added, the resulting mass turned and raked, add non-volatile mineral oil in proportion of 10 to 15 per cent. of oil to the weight of the cement. Turn the concrete with shovels two or three times, raking while turning; the oil will quickly emulsify and become thoroughly mixed in the concrete.

If machine mixing is employed, use a batch mixer, turning a sufficient number of times to mix thoroughly the cement, sand, crushed stone or gravel and water. Then add 10 to 15 per cent. of non-volatile mineral oil. Turn again the same number of times as it requires to mix xthe concrete. The oil will quickly emulsify and become thoroughly incorporated in the concrete.

Oils added to concrete in proportions of from 5 to 15 per cent. will slightly delay the initial and final set. Increasing the proportions of oil will further retard both the initial and final set and hardening, but up to 15 per cent., from experiments so far made, it would seem that the retarding of hardening will not be sufficient to cause the work to be uneconomical.

The tensile strength will necessarily be reduced, and with the increasing percentages of oil toughness will be slightly diminished, but not in proportion to the increase in the percentage of oil used.

An exteremely interesting paper was read at the meeting of the Association of American Portland Cement Manufacturers, at the Hotel Astor, New York, December 15, 1909, by Logan Waller Page, Director Office of Public Roads, Agricuitural Department, Washington, D. C., on the subject of "The Possibilities of Portland Cement as a Road Material," in which he described some investigations being carried on by Dr. Allerton S. Cushman in the laboratory of the Office of Public Roads to ascertain the practicability of mixing semi-asphaltic base oils with Portland cement concrete, with the object of obtaining the desirable properties of both Portland cement and asphaltum. So far only pats and briquettes have been made; the results so far obtained show ample strength for ordinary work: 6-inch cubes will be tested later.

It is believed that compression tests will show greater strength than the usual relation of compression to tension. This is a matter for further investigation, and it is to be hoped that chemists and cement testers will actively take up this work and carry on investigations covering long time periods.

Two months ago the writer made some briquettes and pats with the object in view of ascertaining if the mixture of oil with wet neat cement and

mortar would have the tendency of keeping all but the excess water from leaving the wet neat cement or mortar.

Briquettes were made, neat cement mixed with water, the water slightly in excess of that usually required, after which 10 per cent. of oil petrole was added. (Oil petrole is a white non-volatile petroleum product of about the consistency of melted vaseline.) Pats were made of 1 part cement, 3 parts sand mixed with water, a little in excess of what would ordinarily be used, after which 10 per cent. of the same oil was added. These pats are about 2½ inches in diameter and ¼ inch thick.

As soon as made they were left in dry air. The initial and final set were found to be normal. They were never immersed in water, but remained in dry air for several weeks. No cracks occurred, and they became so hard and strong that these pats, ¼ inch thick, were very difficult to break by the use of the fingers and thumbs. After remaining in dry air for three weeks they were put out in freezing temperature for three days, and again placed in dry air over the radiator. No cracks or checks have occurred.

After remaining in dry air for a month, a test for absorption was made. A broken pat was weighed dry and found to weigh 94-64 oz. It was then immersed in water for several hours. Upon removal from the water the surface water was quickly removed with blotting paper, the pat immediately weighed and found to weigh 99-64 oz. Only 5-64 oz. of water was absorbed.

The fact that the pats were never immersed in water and showed no evidence of checking or cracking, and became hard, would indicate that the emulsified oil had held the water in the mortar, and that such mortar was therefore both non-evaporative and non-absorbent, which would tend to show that concrete in which mineral oil has been mixed would not be likely to contract, and therefore contraction cracks would be avoided.

Furthermore, the resulting mortar appears to be far less brittle, and therefore such treatment should admirably serve the purposes required of concrete retaining walls, foundations enclosing cellars, tanks, cisterns, etc.

Exhaustive tests have been made by a number of authorities on the action of oils on concrete. The effect of oil on concrete and the effect of oil emulsified in concrete are two separate and distinct subjects. We are informed by reliable authorities that concrete immersed in animal or vegetable oils will in time disintegrate, and that concrete immersed in mineral oils is unaffected. In the first incent. grade, 40 feet width between curbs, and no railroad tracks.
stance there was no chance for the oil to emulsify; in the latter the oil is separated into minute globules.

A mere casual glance at the uses of Portland cement concrete would indicate that oils mixed with the concrete would prove very desirable for dustless waterproof floors for office buildings, for slaughter house non-absorbent floors, impervious concrete drain tile and sewers.

Contraction cracks will be eliminated in cisterns, drinking troughs, live stock feeding floors and platforms. Some objection may be raised to the use of oil mixed concrete from the standpoint of its liability to flavor the water or the food. If we stop to consider that the oil is divided into minute globules, thoroughly emulsified, we will see that while there may be some odor there is not likely to be any taste after the drinking trough, feeding floor or cistern has been in use for a few days.

Such oil mixed concrete will also be particularly adapted to terrazzo floors. The great objection at present is due to contraction cracks. A white oil may be mixed with Portland cement, white sand and water, and used for the purpose of setting brick and stone; it being non-evaporative and non-absorbent, no efflorescence or stains can occur. In fact, such concrete can be used in any work not requiring extraordinary compression strength, and in which the concrete does not come in contact with heat. One of the particular advantages will be for stucco work and exterior plasters.

Like many discoveries, this only proves to be a rediscovery. In the first century, A. D., Marcus Vitruvius Pollio, the famous Roman architect, gives the following detailed specification for stucco: "A mixture of well hydrated lime, marble dust and white sand mixed with water, to which mixture is added either hog's lard, curdled milk or blood." In A. D. 1280, at Rockingham Castle, England, melted wax was mixed with the mortar. In A. D. 1324, in the work of King Edward II, at Westminster, pitch was mixed with mortar.

The permanency of the Roman stuccoes may be partially accounted for by the use of oil mixed with mortar. Although Vitruvius used hog's lard, an

animal oil, the mortars have withstood the action of the centuries, and in places where freezing temperature occurs in winter and great heat in summer. However, the hog's lard must have been very thoroughly emulsified by the action of the hydrated lime. Portland cement was unknown at that period.

Lime, sand, and animal oils have stood the test of centuries; Portland cement and animal oils have not yet had this opportunity. It is within the range of possibility that the test of time may prove contrary to the theory and animal oils emulsified be found not dangerous, and we will then consider a remark made by a very noted chemist: "If theory conflicts with the fact, we will have to change the fact."

TOLEDO'S NEW WATER FILTRATION PLANT.

By B. M. Baker, Toledo, Ohio.

THE accompanying photographs show some of the more interesting features of this big $900,000 water filtration plant for Toledo, O., upon which work has been steadily progressing since 1906. Photograph 1 gives a view of the filter house, showing the location of the operating stand for operating the valves which control the flow of water to and from the filters. Each filter is entirely separate from its neighbor, thereby allowing the use of any number or quantity of filters to be operated at one time. These operating stands are a new conception, and bring the operator in close connection with the filter during the process of washing. There is also to be erected in front of each filter a movable stand on which gauges will be mounted to be used in connection with the filters. These are loss of head and pressure gauges, and also a gauge showing the operation of the rate controller. In the background of the photograph is shown the second floor of the main entrance to the building.

I. TOLEDO FILTRATION PLANT.
Filter House, Showing Operating Stands.

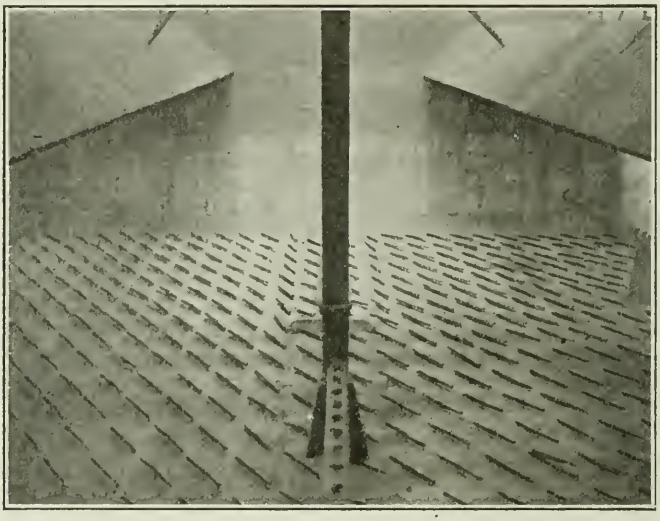
The filter house has a temporarily constructed wall at the west end which will allow of the extension of filters at any time, so that 10,000,000 additional gallons can be added to the capacity without changing the settling basins. Below the floor is the raw water duct supplying the filters.

Located directly beneath the room shown in the foregoing described picture is the pipe gallery, the most perfect pipe gallery which up to this time has ever been designed. Overhead is

the raw water duct and below the floor the clear water duct is located. This gives entirely free and unobstructed passageway the full length of the filters, all valves, pipes and rate controllers being located upon either side and easily accessible. The gallery is brightly lighted by electric lights, a bulb being located in front of each filter. The floors, beams and columns are heavily reinforced by concrete, care being taken to avoid shrinkage and cracks, thus preventing leakage. Vertical joints were left to be afterwards calked and made tight, the object being to confine the cracks to known places where they can easily be watched and kept in repair.

The next photograph shows the strainer valves in the bottom of the filters. These valves are small brass tees, screwed into cast iron laterals, these in turn being leaded into a cast iron pipe in the center of the bed, connecting from there to the pipe gallery. This cast iron pipe is covered with concrete to the bottom of the tees, thus minimizing the distance between them and the floor. The strainer valves are covered with fine saw cuts, permitting an easy flow of water and fine enough to prevent the sand from entering. These valves are in turn covered with 9 inches of gravel, graded from fine to coarse, the top of the gravel coming just below the horizontal air pipes shown in the picture. These air pipes will be a series of small brass pipes fastened into the small tees shown in horizontal air pipe mains, at right angles, thereby covering the entire bed. On top of this is located the sand, extending to the bottom of the wash troughs shown in the picture, the air being used in connection with washing filters to agitate the sand. The wash water enters the filters through the strainer valves, thereby reversing the flow of water during the process of washing, the wash water being supplied from pumps in the main building.

The clear water basin has groined arch roof and floor. In dimensions this clear water basin is 250 feet square, and is built entirely of concrete arches 5 inches thick at the crown. The basin is almost entirely under the natural surface of the ground. In order to make an air-tight floor as nearly as possible, it was cut up into 15-foot squares, each square or pedestal making a bearing for a column. These blocks or pedestals were built in alternate sections, steel plates being placed around the edges in building the intermediate sections. These plates were previously greased and drawn after the concrete was set, the opening left being filled with asphalt. This basin is connected with the clear water conduit, which flows along one side, by a 30-inch pipe controlled by a sluice gate, thereby allowing the water to go and come in the basin according to the rate of pumping in two stations. The clear water basin is covered with earth which is



II. TOLEDO FILTRATION PLANT.
Collecting Pipes or Strainer Valves in Bottom of Filters.

18 inches thick at the crown, the pockets over the columns being covered with sand and gravel and provided with weep holes. The ground thus provided will be developed as a park with grass, flowers, walks and drives.

The main building is of concrete construction with sandstone accompaniments to the second story, which is of stained brick with sandstone trimmings and a tile roof, being in plan 51 feet by 275 feet.

The view of the supply pipe from the pumping station to the main building, Plate III, shows part of the pumping station in the background and one line of the pipe laid, the other pipe not being finished. This pipe consists of riveted steel, 42 inches inside diameter, coated with an asphalt mastic. This picture also shows the method of constructing a curve, great care being taken to protect the coating.

This riveted steel pipe, while much used throughout the west, is a new idea in this locality in such sizes laid underground. The authorities gave the matter considerable thought and investigation before concluding to use it in the filtration plant, but it was finally concluded to be the best for this purpose, being much cheaper, lighter and easier to handle than iron pipe, and it is believed durable enough to last until a new plant is needed to keep up with the march of progress and fulfill the ideas of the coming generation.

III. TOLEDO FILTRATION PLANT.
Riveted Steel Supply Main. Power House in Background.

THE CHARACTER OF STREAM POLLUTION AS AFFECTING PURIFICATION PLANT DESIGN.*

By H. E. Jordan, Chemist of Indianapolis Water Company.

THERE are two controlling factors which enter into the design and operation of all water purification plants. The first is the character of the raw water supply, as affected by the various forms of stream pollution which have entered previously, and the second is the necessity for the production of a finished product of relatively uniform character; and by the term "relatively uniform character" is not only meant the uniformity so far as

*A paper before the Indiana Engineering Society.

local conditions are concerned, but also a general uniformity as regards all cities having public water supplies, for it is a recognized fact that in the travel of persons from one place to another they are constantly comparing the quality of one drinking water with another, and by their statements and comments are influencing the opinions of the consumers of any supply as to character.

The quality of the raw water supply as taken at any purification plant in this country at the present is, of course, modified by the discharge of various forms of domestic and factory wastes into the water courses, and one of the questions which has always been a source of contention between water supply organizations and up-stream municipalities or corporations is the degree to which those up-stream shall purify their wastes. Within the last few years the question appears to have resolved itself into a sort of agreement to the effect that sewage or waste purification shall simply consist of such operations as will render the effluent relatively free from suspended matter and not liable to putrefy when discharged into a running stream. The further considerations of bacterial removal and the refinements as to color, taste and suspended matter are to be left to the water purification plants.

Stream pollution, as to the character of the material, may be roughly classified into mineral and organic pollution. By the term "mineral pollution" is meant such things as suspended clay and sand. Under the class of "organic pollution" may be placed most all of the domestic and factory wastes, along with colors and odors sometimes produced in water supplies by swampy water-sheds or growths of algæ. The methods of removing these are best illustrated not by technical discussion of the character of each and the theoretical process which might be applied in this removal, but by definite illustrations of water purification plants which have been forced to meet these different problems.

As an example of a water purification plant satisfactorily operating with a water of relatively low turbidity and color, but somewhat affected by domestic sewage, there is the filtration plant at Lawrence, Mass. This probably, in a great many of its characteristics, represents the simplest form of a plant which may be used for water purification, consisting simply in a series of slow sand filters, operating at a normal rate of two and one-half to two and three-quarter million gallons per day, and producing a water perfectly satisfactory in point of its bacterial content. The absence of any extreme fluctuations in point of suspended matter and color render it unnecessary for any preliminary treatment to be used. The investigations which have been conducted from time to time at the plant have indicated that rates as high as five or six million gallons per acre may be used, and at the same time produce an effluent of practically the same quality.

On the Hudson river the purification plants at Albany and Poughkeepsie, both in their likenesses and differences, are interesting as examples of modifications which differing characters of stream pollution necessitate in the design of the plants. At Albany the Hudson river is very considerably affected by the presence of domestic sewage, which not only has produced a high bacterial content, but a considerable proportion of organic matter in solution. There is also a slight amount of color and suspended matter in the river at this point. The original installation at Albany consisted of eight covered filters, preceded by a settling basin of a rated capacity somewhat less than a day's supply. The operation has always been very successful so far as would be indicated by the improvement of the public health conditions; yet there was during the operation of the plant under these circumstances a bacterial content produced at certain seasons of the year which in point of numbers was excessively high. At the same time the operation of the plant from a mechanical standpoint was becoming constantly more difficult, on account of the deposition of suspended matter within the lower sand layer. The modification made in 1907 consisted in the construction of a series of roughing filters, which are situated between the settling basin and the final filters. In point of general design they are very similar to the conventional mechanical type, but operate without the use of any coagulant. It has been possible by their operation to remove the difficulties which were encountered in the sub-surface clogging of the slow sand filter layer, and at the same time to increase the ordinary rate of operating so as to produce from two hundred to two hundred and fifty million gallons per acre between cleanings, instead of approximately ninety, as was the case before the modification, and at the same time these changes have been accompanied by a general reduction of the bacterial content of the filtered product.

At Poughkeepsie, N. Y., further down

the same river, there is situated one of the older filtration plants of the country, which had operated for a number of years on the same general lines as the Albany plant, with a raw water of slightly lower average bacterial content, but had become involved in some of the same difficulties as to abnormally high bacterial content at certain times, and operating difficulties, so far as cleaning and maintenance of the sand layers were concerned. At this place there has been added to the settling process the additional feature of coagulation, and at times of extreme turbidity the raw water is treated with sulphate of alumina, allowed to pass into the settling basin, where the suspended coagulant and clay are allowed to settle out, and from thence passed to the filters. It has been the case here, as was the case at Albany, that by the pre-treatment process those features of the stream pollution which were rendering the operation of the plant erratic have been successfully removed.

These two plants represent a filtration system which is forced to deal with a water somewhat polluted by pulp wastes, highly polluted by domestic sewage, and moderately affected by varying amounts of suspended matter. The results from the two plants indicate that with the modifications that have been recently made the purification and mechanical and cost efficiencies are satisfactory. It is not possible at this time to reach any conclusion as to the relative efficiency of the modifications at these two plants, because the operation has not extended over a sufficiently great period of time.

At Little Falls, N. J., in 1902 there was installed a mechanical filter plant which was probably the first one of particular note in this country to be constructed to handle waters which might not be classed as turbid. At Little Falls the raw water supply is principally affected by an abnormal color, due to the presence of a large amount of vegetables extractions which have been picked up in the upper stream flow through swampy regions. It has been an admitted fact that the operation of slow sand filters is not markedly successful in the removal of color, while the use of such coagulants as sulphate of alumina has been successful. The operation of the Little Falls plant has justified the expectations of those who designed it, and it has been possible to satisfactorily reduce the color and at the same time produce a water of sufficiently stable and low bacterial content to insure its healthfulness as a source of supply.

The Potomac river at Washington represents a stream of somewhat different character as to the nature of its pollution from these above mentioned. In this case, although there is a large amount of domestic sewage flowing into the stream above Washington, the characteristic feature of the stream pollution is the large amount of exceedingly fine suspended matter, due to the erosion of the soil in the upper stream flow. At this place there was constructed a slow sand filter plant, which received its supply from a series of reservoirs, so arranged as to give ordinarily about six days' settling. It has been found in the course of the operation that although the plant was quite successful as a remover of bacterial life, the complications resulting from the persistence of very fine suspended matter, even after so long a period of settling, rendered the operation of the plant somewhat difficult. Extensive investigations have been made by Hardy and Longley at this place, and it has been recommended that a coagulant be applied to the water at a certain stage in the process of settling, so as to remove these finer particles of suspended matter. Experimental data which have been accumulated indicate that such process will, with the remaining amount of sedimentation, effectively remove all of the disturbing elements which have been at the plant, and enable slow sand filters to operate successfully.

At Harrisburg and Steelton, Pa., are met two plants dealing with another character of stream pollution. The Susquehanna river, which is the source of supply for both, is somewhat affected in its upper area by coal mine wastes and suspended matter at time of excessive rainfall. So far as the bacterial content of the Susquehanna water is concerned, it apparently would be possible to saisfactorily purify this by slow sand filtration if it were not for these results of deforestation and industry, but with these complications it has been necessary to modify the method of purification. At Harrisburg there has been installed a mechanical plant with a coagulation basin so arranged that at times of excessive turbidity it may be partially used as a means of plain sedimentation, and then, after a certain period, the water treated with coagulant and passed to the filters. The difficulty in the operation at Harrisburg seems to have been due to the fact that although there are seasons of the year when the suspended matter is so excessively high as to render the purification best done by a me-

chanical plant, there are other seasons when the suspended matter is practically a minus quantity, and the other factors of bacterial content and proportion of organic matter so low that there is no basis upon which satisfactory mechanical filtration can be carried on. On account of this fact it was necessary at different times for clay to be added to the water entering the plant, in order that the coagulant might successfully form and assist the operation of the mechanical filters.

At Steelton, Pa., the development of the purification plant has been somewhat different. There is first a grit chamber, followed by a roughing filter, and that in turn by slow sand filters. The idea of operation is briefly this: that at times of low turbidity the roughing filters will be used to remove a portion of the bacterial life and practically all of the suspended matter, and the slow filters simply used as a means of finishing the product. At time of high turbidity the grit chamber is effective as a remover of the coarser suspended material. At the same time there is added to the water a certain amount of coagulant, which, collecting together the suspended particles, is removed by the roughing filters. Their effluent at this time is somewhat higher in point of suspended matter and bacterial life than at times of low turbidity, and in this case the work of the sand filters becomes more directly comparable to those conditions which are met in the plain sand plant at Lawrence, Mass.

In and about Pittsburg, Pa., there are three filtration plants operating on river waters of somewhat similar characters. The supplies as provided at McKeesport, Pittsburg and South Pittsburg are all taken from rivers at normal seasons slightly affected by suspended matter, but highly polluted by domestic sewage. At times of rainfall the erosion of the soil on the sloping hillsides produces a great amount of suspended matter. The abrupt fall in the stream flow is also responsible for a very rapid carriage of sewage from up-stream points down past these cities. There is the further effect of industrial wastes particularly characteristic of this district, in the presence of acids from coal mines, and large amounts of iron from the various steel plants. The result of these various polluting factors has been to produce a water supply at times of low water excessively hard, sometimes acid in character, and containing large amounts of iron, ordinarily as sulphate. At times of excessive rainfall these conditions may be somewhat lost sight of in the large amounts of turbidity, and at all times there is the controlling feature of the purification process in the necessity of removing large amounts of sewage. Although there has been some extremely valuable study made upon the treatment of these raw waters, the results of operation indicate that as yet the problem has not been completely solved.

At McKeesport the filtration plant is combined with a softening process, where by means of the customary chemicals, lime and soda, reduction in hardness is effected, and on account of the presence of the dissolved iron the water is subjected to coagulation, which, after some sedimentation, produces a product almost free from suspended matter, which is then passed through mechanical filters. At Pittsburg there is provided a settling basin of approximately eighteen hours' capacity, followed by slow sand filters, which operate at a maximum rate of two and three-quarters million gallons per acre. It is, of course, not possible for this plant to effect any modification in the character of the water, so far as the industrial wastes are concerned, and the conditions as to hardness and acidity, if present, remain in the finished product. The controlling difficulty apparently in all of the plants is the extreme rapidity with which fluctuations occur in the raw water supply. The large volume of industrial wastes, varying from time to time, and the extreme modifications produced by rainfall, effect a rapid change in the river water, and at all of the plants these changes must be immediately met by a modification of the operation, if the difficulties are to be overcome. It will be recognized that in these instances the requirement as to the proper disposal of factory and domestic wastes is not being met in this district, and that with this accomplished there will be a certain modification in the conditions described. There is, on the other hand, a certain question as to whether the magnitude of these various industries does not make it more advisable to improve the purification processes a little more greatly than would be the case under different conditions. The difficulty of rapid fluctuation could be met by the provision of large impounding or settling reservoirs, and this would assist greatly in the production of a uniformly purified effluent.

At Toledo, Cincinnati, Louisville and New Orleans the character of stream pollution is notably one of suspended

matter. The various conditions as to bacterial content and color are lost sight of in the continuous and high amount of turbidity, and the operation of the plants is, in general, successful, if by the conventional operation of mechanical filters the turbidity is removed. There are, of course, various modifications at the different plants along the line of individual preference, but in all there is the general division into the settling, coagulation and rapid filtration processes.

The Indianapolis plant, in certain conditions, is quite comparable in the character of its raw water supply to the installation at Harrisburg and Steelton, where the raw water is, during a large portion of the year, quite free from turbidity, and at other times subject to considerable amounts. There is no difficulty here on account of coal mine or industrial wastes. The design and operation of these three plants, as a matter of fact, seem to be leading toward the same general design, although the original installations have been somewhat different. Although the Harrisburg plant is a mechanical one, it has confronted the difficulties, as stated previously, of insufficient amounts of suspended matter to render its operation successful at certain seasons of the year. The Steelton plant is, perhaps, the most thoroughly hybrid of any filtration plant in the country, in that it represents all the different modifications between mechanical and slow sand filtration. The Indianapolis plant, on the other hand, may be characterized as a slow sand filter plant, modified by preliminary process of sedimentation, and further modified at times of excessive turbidity by the coagulation process.

It is a long step in water purification from the plant at Lawrence, Mass., to the one at St. Louis, Mo., and yet it will be recognized, as a person studies the modifications of water purification in travel from the east to the western portion of the United States, that they have been gradual, and from a slow sand filter plant operating with a raw water of moderate bacterial content and low amounts of suspended matter and color, we perhaps reach the best known example of the other condition at St. Louis, where the raw water supply is affected by extreme and persistent amounts of suspended matter of relatively coarse size, and the removal of which constitutes the essential feature of the purification process. At St. Louis, as is also the case at Kansas City and a number of plants dealing with water of this same character, the purification is effected by coagulation, the effect of the process being that on account of the excessively coarse size of the suspended particles the settling following coagulation is extremely rapid and thorough, and at all of these places, although the sentiment as to the necessity of further treatment by filtration is somewhat different, the opinion on the part of the users of the supply is one of satisfaction at the removal of the grosser pollution.

It is not possible to leave out of further consideration the modification of purification plant design which is being effected by the development of the use of hypochlorite of lime as an agent in reducing the bacterial content. The operation of filter plants in times past has always hinged more or less upon the fact that reduction depended upon the accumulation in the sand layer of a certain bacterial growth. Differences as to growth at different seasons and various rates of operation have always given difficulty in the production of a uniformly purified effluent with this more or less uncontrollable agent. It has been developed in practice that colored waters may be reduced in that characteristic by the use of coagulant and the proper sedimentation and filtration; that turbid waters may also be improved as to that characteristic by the use of coagulant and sedimentation alone, or filtration. The variations above mentioned, however, made it always a more or less uncertain question as to what results would be attained in the removal of bacteria. It is in this regard that the use of hypochlorite of lime is valuable. This material is an unstable combination of lime with oxygen and chlorine, which in solution breaks up and, as used in water purification, becomes an active oxidizing agent, reducing the organic life and destroying bacteria. Unlike many other materials which might be used in the same way, there is no residual product of which there can be any complaint made, the result being a slight increase in the amount of carbonate of lime present in the water. Its use as a means of sewage purification has been well known for some time, but as an adjunct to water purification its use must be dated from the work of Johnson and Jennings at the Stock Yards plant in Chicago. This installation is one where the raw water is nothing more nor less than dilute sewage, and by means of coagulation, mechanical filtration and hypochlorite the finished product is favorably comparable to the supply furnished by the municipality of Chicago. Since the work at this

plant the development of its use has been well-nigh universal. The water supply for Jersey City is an impounded one, very slightly affected by any pollution other than small amounts of bacterial life. It has been satisfactorily relieved of this by the use of a small amount of hypochlorite of lime. At Little Falls, N. J., and Harrisburg, Pa., the use of hypochlorite has made it possible to reduce the amount of coagulant used in connection with the mechanical filters, and at the same time producing a finished product of more uniform character. Experimental data accumulated at the Torresdale plant in Philadelphia, and at Albany, N. Y., indicate that it is applicable as an adjunct to roughing filtration. Studies by Gage at Lawrence, Mass., in fact, indicate that the Merrimac river water, which is the supply for the Lawrence plant, could be satisfactorily purified by the use of filters operating without coagulant, at rates of one hundred million gallons per acre per day, in which the bacterial reduction would be effected by the application of hypochlorite just before filtration. Its use in connection with the clarification of extremely turbid water as an agent of minimizing the amount of bacterial life has been demonstrated to be successful. In all of these various operations where this material has been used as an adjunct to the purifying process, the additional cost which it incurred is so slight as to be almost a negligible quantity, generally running from 10 to 25 cents per million gallons of water purified. Although the use of any new means of water purification has always been and probably will be accompanied by certain mistakes of over-anxious experimenters, there is no question that the use of hypochlorite will become practically universal, and must be taken account of in future designs of purification plants.

The modifications, then, that varying characters and degrees of stream pollution necessitate in the design and operation of a filtration plant are quite apparent. Experience at these plants, as above noted, indicates that in the case of water slightly affected by color, suspended matter and bacterial life, plain slow sand filtration is entirely adequate. Water of this character, as developed by the experiments of Gage, may also be handled by rapid filtration, preceded by the use of hypochlorite. For water affected by dissolved color, mechanical filtration preceded by the use of sulphate of alumina is most effective. Water of the character such as is met at Albany and the Torresdale plant at Philadelphia, high in bacterial life and organic matter, is best treated, not by any means of single filtration, but by settling, roughing filtration and final slow sand filtration. In these cases it appears that the additional use of hypochlorite will make it possible for the process to be very much condensed, and it is probable that the final slow sand filters may also be operated more nearly at mechanical rates or entirely eliminated.

The modification of purification systems due to suspended matter, of course, depends altogether upon its duration and intensity, and may be successfully handled by installations in all degrees of difference between such a one as is installed at Washington and the pure mechanical type such as at Cincinnati.

Finally, those waters carrying constant and high amounts of suspended matter of coarse size are satisfactorily purified by coagulant, sedimentation, and the recent modification of the use of hypochlorite.

The progress in water purification during the last fifteen years has been rapid, although the difficulties that investigators have had to meet were great. The recent developments of the use of bleaching powder and the increased knowledge as to the value of roughing filtration seem to indicate that within the next decade the problem of satisfactory water supply will reach a very definite and satisfactory conclusion.

EDITORIAL COMMENT

Pollution of Inter-State Streams

Nominations for Office Under the Commission Plan of Municipal Government

POLLUTION OF INTER-STATE STREAMS.

Inter-state streams are of two classes: Those which flow for a portion of their length through one state and then pass into another state, and those which form boundaries between states. In either case pollution of the stream in one state is liable to produce damage in another state. Thus far there has been no apparent method of dealing with a case of this sort.

The state of Ohio has made a thorough study of this matter, especially in connection with the pollution of the Ohio river, and the Attorney General has given an opinion to the effect that the U. S. Government can give no relief so far as pollution coming from another state is concerned, but that the laws of the state control pollution of the Ohio river within the state, so that a city whose water supply is contaminated by any other city or industry within the state can take the necessary steps to stop the pollution.

The law passed by the Indiana Legislature last year is not so inclusive, for it expressly excepts from the operation of the law cities on streams along the boundaries of the state which are polluted from sources outside the state which are permissible under the laws of the other state.

The state of Ohio is encouraging a movement toward co-operative action among the cities along the Ohio river. Joint meetings have been held with representatives of some of the states, and others have expressed their desire to co-operate. The Ohio resolution, which is approved by Pennsylvania and West Virginia, is to the effect that the respective legislatures should enact a law to prevent the introduction of any additional sewage into the Ohio river or any of its tributaries which affect the water supply of any municipality. The passage of such law by Pennsylvania and the states west of it, bordering on the Ohio river, would do much to show what the states themselves can do in protecting each other. It is one of the pieces of uniform legislation toward which the states generally are working as the only method of solving some very vexing problems.

NOMINATIONS FOR OFFICE UNDER THE COMMISSION PLAN OF MUNICIPAL GOVERNMENT.

There are now several methods of securing candidates for municipal offices in use under the various forms of the commission plan, and some comparison of a few of them may be of interest.

If Memphis may be considered the original city adopting the commission plan, the earliest method of nominating candidates was by the regular party machinery.

The first modification was nomination by petition, reducing the number of elective officers to four or five, who, after election, should determine which offices they should fill, the same body having the duties of supplying the necessary funds and spending them. In some cities the number of names required on the petitions for nomination is large enough so that the number of candidates is automatically reduced to the minimum, including only those who really want the offices or represent some principle or movement of sufficient importance and interest to induce citizens to put forth the effort necessary to get the signatures. In others, such as Berkeley, California, a college town, the number of names required on a petition is only twenty-five, so that there may easily be an indefinite number of candidates.

The latest developments of the commission plan approach the older plans

in some degree, Boston, for example, electing a mayor and a council, putting into the hands of the council the legislative matters and into the hands of the mayor the administrative matters, the latter appointing the boards or individuals put in charge of the various departments. Berkeley elects mayor, auditor and councilmen.

The earlier forms, most of them applied to cities of some size, provide that the persons receiving the highest numbers of votes shall be elected. But where the number of candidates is practically unlimited, this might result in the election of persons representing only a small proportion of the population. In Berkeley, therefore, it is required that no one shall be declared elected unless he has received a vote greater than half the number of votes cast. In case this causes failure of choice at the first election, a second election is provided for three weeks after the first election. At this election the number of candidates is reduced to two for each office, being the two receiving the highest numbers of votes at the first election. If four out of five councilmen were not elected at the first election, for example, then the eight not receiving majorities who were next highest in the polls would be the candidates for councilmen at the second election.

The methods at present in use may be grouped in general classes, overlapping somewhat, as follows:

1. Nomination for general legislative and administrative service, particular service assigned after election.

2. Nomination for special service, legislative or administrative.

3. Nomination for legislative and head of administrative offices and later appointment of department heads.

4. Nomination by petition with large number of signers.

5. Nomination by petition with small number of signers and an election which is in effect a non-partisan primary in case a candidate does not receive a clear majority.

The objections to the lottery authorized under the first class have already been stated. The second class removes one of the elements of the lottery, since the candidates are nominated for specific offices, but either political nominations or nominations by petition may fail in putting up proper candidates for strictly technical administrative offices or in electing them if nominated. The responsibility is also distributed too widely if each official is responsible directly and independently of the head of the government to the voters only. The third class of cities seem to have the arguments in their favor, and the facts also, so far as their influence is not modified by errors in methods of nomination included in the fourth and fifth classes.

The purpose of the present article is to call attention to the effects of the methods of nomination in these two classes.

Boston has recently held its first election under a charter falling in the fourth class. There were four candidates for mayor and the successful candidate secured not quite half the total number of votes cast for the office. Many citizens point to his former administration as evidence of his unfitness for office, but the fact remains that he did receive nearly half of the votes cast. There was the unfortunate division of strength between two good candidates which so often occurs, the vote indicating that if one of them had not run the other would have been elected. It is undoubtedly true that the city of Boston gets the best government that the majority of its citizens wants, and deserves what it will get. It is also probably true that the vote of the majority was so scattered that it did not have its full effect. And the question arises as to how it can secure the full results of its real power if that power is rightly applied.

The non-partisan primary included in the fifth class of nominations suggests a possible remedy. This has been applied in a small city, Berkeley, which has the further advantage of being a college town, so that the method must be applied with care in a larger city, in particular. The first election is not called a primary, but is the municipal election, and if any candidate has a majority of the votes cast he is elected at this first election. Thus at one elec-

tion there were four candidates for mayor, and one was elected and took his office on the strength of this election. If, however, no candidate had secured a clear majority, as in the Boston case, the two receiving the highest number of votes are termed the nominees for the office and a second election is held three weeks later, at which one of the two must be chosen.

It would have been possible, had this method been applied in the Boston case, for the "good citizens" to come out and vote at the second election for their one candidate and thus elect him. However, the size of the poll at the second election must be considered. The first election is the most important, and will probably draw the largest vote. In Berkeley at the election mentioned it was 25 per cent. greater than that at the second election. The stay-at-home vote at the second election is likely to be taken from the so-called "good citizen" class, and demonstrates poor rather than good citizenship.

On the other hand, the city of Memphis at a recent election, when the mayor was the only officer elected, showed the utmost interest in this, its first non-partisan election, and cast the largest vote in its history.

The expense of an election is great in a large city, and this must be considered in preparing for a possible double election. The expenses of candidates and of their machinery are still greater in a large city than in a small one where practically every candidate is well known by most of the electorate.

One way to diminish some of the difficulties in municipal elections would be to limit the franchise to the stockholders in the corporation, i. e., those who have enough property to find a place on the tax list.

THE QUESTION DEPARTMENT

Books on Electric Light and Gas Plants.

Can you refer me to good books that will assist me in making plans and specifications for an electric lighting system and a gas works for a city of 10,000 inhabitants. I want the latest on the two subjects, that will enable me to provide the best lamps, wiring, machinery and distribution and the proper sizes and proportions of gas machinery, holders, distributing mains, etc. What can you refer me to in MUNICIPAL ENGINEERING on the subject?

E. B. D., City, Engineer, ——, Ind.

Good books on electric lighting are Houston and Kennelly's "Electric Arc Lighting" ($1) and "Electric Incandescent Lighting" ($1)); Atkinson's "Elements of Electric Lighting" ($1.50); Cushing's "Standard Wiring for Electric Light and Power" ($1); Wiener's "Dynamo Electric Machines" ($3); Crocker's "Electric Lighting" ($3); "Distributing System and Lamps" ($3).

The latest American book on gas making is Latta's "Handbook of American Gas Engineering Practice" ($4.50). Good recent English books are Newbigging's "Handbook for Gas Engineers and Managers" ($7); and Hole's "The Distribution of Gas" ($4). A longer list will be found in vol. xxxv, p. 35. American books on gas manufacture are scarce.

The new electric and incandescent gas lamps have not yet reached the textbooks. Articles concerning them and other branches of the subject of lighting of interest in connection with the question will be found in recent volumes of MUNICIPAL ENGINEERING as follows, with some others in this number:

Vol. xxxviii: "Street Lighting," p. 15; "Arc and Other Electric Lights," p. 44.

Vol. xxxvii: "Municipal Gas Plant Experiences," p. 315; "Modern Lighting System for Mishawaka," p. 115.

Vol. xxxvi: "Tungsten Lamps Compared with Arc Lamps," p. 216; "Quality of Gas," p. 286;' 'Forms of Contract for Electric Current," p. 316; "Municipal Street Lighting Plant," p. 373; "Rates for Lighting and Contract Provisions," p. 33.

Vol. xxxv: "The Arc Lighting System of Portland, Ore.," p. 234.

Vol. xxxiv: "Flaming and Metallic Arc Lamps," p. 235; "Tests of Electric Lamps," p. 306.

Vol. xxxiii: "Improvements in Electric

Lamps," p. 388; "Comparison of Electric Lighting Systems," p. 348.

Vol. xxxii: "The Municipal Electric Light Plant of Hagerstown, Md.," p. 291; "Data on Municipal Ownership of Water and Light Plants," p. 98, giving references to many previous articles.

Officers of National Electric Light Association.

Please give me the address of the secretary of the National Electric Light Association or where or how I may get a copy of the standards they have adopted for the various kinds of machinery used in electric lighting.

E. B. DOUGLASS, City Engineer,
Seymour, Ind.

The officers of the National Electric Light Association are Frank W. Frueauff, Denver, Col., president, and Frank M. Tait, Dayton, O., secretary and treasurer. The association also has headquarters in the Engineering Building, 29 W. 39th St., New York City.

Distribution of Charges for Electric Power.

Would you kindly furnish solution of the following question through the medium of your valuable periodical.

A municipal power plant furnishes three departments with energy, each having load factors as follows: 40, 32, 15. The total cost per unit of energy, including fixed charges is 5 cents, determined by dividing the total monthly cost, which includes proportion of fixed charges, by the total monthly output of energy.

We wish to be instructed in the proper manner of dividing this unit cost, taking into consideration the load factors. If you do not consider this method feasible please state some method of division which is more practicable and correct.

SUBSCRIBER,
————, Alberta.

It is assumed that the power named is electric power.

This subject was quite fully discussed by the Wisconsin Railroad Commission in the case of the Menominee and Marinette Light and Traction Co., decided Aug. 3, 1909, and reference can be made to the printed decision for details.

An electric power plant must be large enough to carry the entire load which can come upon it at any time. The maximum capacity is reached by the output but a few minutes during the day. The remainder of the time the machinery is operating well below its capacity, and it may indeed not operate during a part of the day. In like manner a customer of the plant may operate at his maximum rate but a part of the day and at a lower rate the rest of the day, or may stop entirely for several hours in the twenty-four. He must, however, be able to get his maximum power at any time that he wants it, at least within the terms of his contract.

It is evident, therefore, that a part of the cost of operating the plant, including maintenance and capital charges, is dependent on the required capacity to meet the maximum demands of its customers, independently of the actual output, and that a part is dependent upon the output of current.

The decision referred to goes into detail regarding the various items of capital charges, maintenance and operation, distributing them between the two classes of charges, with reference to both steam and water power, as applied to power plants in general and to the particular plant covered by the decision.

The result is the statement that about 50 per cent. of the total cost should be assessed on the basis of the maximum capacity required, and the other 50 per cent. should be a regular charge per unit of power delivered. There are differences of opinion varying between 70 and 100 per cent. as to the proportion of the overhead charges, such as interest, depreciation and taxes which should be assessed as a capacity charge. These differences would vary the proportion of the total cost to be assessed as a capacity charge from about 47 to about 57 per cent.

For a power plant, therefore, the process of determining the charges to customers would be about as follows:

Determine the total cost of power sold during the month, including all capital, maintenance, depreciation and operation expenses.

Divide this cost by two.

Take the sum of the capacities of the motors connected under contracts and divide the half cost by this sum. This would give the cost per horse power per month, which may be stated on the rate card per day, per month or per year, as preferred. The profits are all included in the capital and depreciation charges provided for. This will be the charge per horse power of capacity of the motors attached to the circuits. When the current is used for lighting the equivalent charge per arc, incandescent, carbon or other light will be made.

Take the number of units of power actually sold during the month and divide the other half of the cost by this number. This will give the charge per unit of power to be made for current used.

The output will vary from month to month, but the overhead charges will vary but little. The receipts from the charge per horse power of capacity will not vary as long as the customers do not change their contracts and these practically constant overhead charges will, therefore, be met by a constant income. The operation charges will vary with the output of current, and the income will vary in the same way. The two will not vary in exactly the same proportion, however, so that it will be necessary to make a charge per unit of power delivered, which will insure sufficient return to pay all cost.

In the case of the Menominee and Marinette Light and Traction Co., the power rates worked out are 50 cents per month for each horse power of nominal rated capacity of motor, or less, and 3.5 cents per kilowatt-hour for current consumed.

For lighting, the active connected load, corresponding to the nominal rated capacity above, is assumed to be 60 per cent. of the total connected load for business or commercial lighting and 45 per cent. for residences, except in cases where the actual demand is known. The rates are 13 cents per Kilowatt-hour for the first 30 hours' use per month of the active connected load, 8 cents per kilowatt-hour for the second 60 hours' and 4.5 cents per kilowatt hour for each additional hour's use per month.

For any other plant the percentage distribution and the rates must be worked out from a study of the conditions of the individual plant.

Books on Town Engineering, Bridges and Roads.

Please send me a list and prices of practical books on engineering for small towns, road building and small bridges of steel and concrete; books that tell how more than why.

F. F. W., Lumberton, N. C.

Following is a list of books on the subjects named with some notes on their contents:

McCullough's "Engineering Work in Towns and Small Cities" ($3) is the book most nearly fitting the first item.

Spaulding's "Text-book on Roads and Pavements" ($2) is the latest book on this subject and the only one giving much detail on the latest bituminous macadam roads.

Judson's "Road Preservation and Dust Prevention" ($1.50) gives practical details in treatment of road surfaces.

Byrne's "Highway Construction" ($5) is the most detailed American book on road building.

Taylor and Thompson's "Concrete, Plain and Reinforced," ($5) gives many practical details on construction of large and small reinforced concrete bridges.

Buel and Hills' "Reinforced Concrete" ($5) and Gillette and Hills' "Concrete Construction Methods and Cost" ($5) also give many detailed examples.

Tyrrell's "Concrete Bridges and Culverts" ($3) is a new book which should meet our correspondent's needs.

A list of books on roads and pavements will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 339. Lists of books on cement and concrete, some of which contain information on reinforced concrete bridges, will be found in vol. xxxii, pp. 306, 380. Following are additional books on the subjects mentioned in the question:

Whinery's "Municipal Public Works" ($1.50), on their inception, construction and management.

Goodhue's "Municipal Improvements" ($1.75).

Morrison's "Elements of Highway Engineering" ($2.50), a college text-book omitting most of the details.

Smith's "Dustless Roads, Tar Macadam" ($3.50) by the city surveyor of Edinburg, Scotland.

Phillips and Byrne's "Highway Construction" ($1), giving modern methods for road builders and all interested in better ways of communication.

Ryves's "The King's Highway" ($2) is an excellent English book.

Turneaure and Maurer's "Principles of Reinforced Concrete Construction" ($3.50), the most practical book on the theory of reinforced concrete.

Brown's "Handbook for Cement Users" ($3).

Reid's "Concrete and Reinforced Concrete Construction" ($5).

Watson's "General Specifications for Concrete Bridges" (50 cents).

Asphalt Contractors.

Kindly give us the name and address of a contractor who is familiar with the cost and also the method of constructing asphalt pavements. Please give us the name and address of your city engineer.

C. O. T., Sullivan, Ind.

Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Asphalt," "Asphalt Pavements" and "Contractors" so far as they use asphalt, for names of such contractors. H. W. Klausman, 410 Majestic Building, is the city engineer of Indianapolis.

Officers of Good Roads Associations.

Kindly advise the writer of the address of the secretary of the American Road Makers Association, also of the International Road Congress at Paris, France; and if you know when the next meetings will be held for these two associations, kindly advise date.

F. B., Minneapolis, Minn.

The officers of the American Road Makers' Association are James H. MacDonald, State Highway Commissioner, Hartford, Conn., president, and E. L. Powers, 150 Nassau St., New York City, treasurer. The time and place of the next convention haveno t yet been announced.

The principal official connected with the Second International Good Roads Congress, to be held at Brussels, is M. Mahieu, 1, Avenue d'Iena, I, Paris, General Secretary of the Permanent International Association of Road Congresses. This organization is promoting the congress, and was formed at the time of the first congress in Paris in 1908.

The congress will be held at Brussels for one week beginning July 31, and will be under the patronage of King Albert the First of Belgium. The honorary presidents are Mr. Schollaert, Ministre de l'Interieur et de l'Agriculture, President du Conseil; Mr. Delbeke, Ministre des Travaux Publics; Mr. Davignon, Ministre des Affaires Etrangeres, and Mr. Helleputte, Ministre des Chemins de fer, Postes et Telegraphes. There are also a number of committees and commissions, including Committee of Patronage, Local Organizing Commission, Technical Committee, Reception and Excursions Committee, Exhibition Committee, etc.

Mr. Samuel Hill, as the vice-president of the American Road Builders, secured recognition of that organization as the official representative of the Permanent International Association in the United States and Canada, and any memberships or papers that may be sent in the care of E. L. Powers, secretary of the American Road Builders, at 150 Nassau st., New York City, will be forwarded.

Specifications for Expansion Joints for Brick Pavements.

Please send me specification for expansion joints and joint filler where cement is used as filler in brick pavement.

O. A. WINNBERG,
Assistant City Engineer, Wausau, Wis.

The specifications prepared by the National Paving Brick Manufacturers' Association will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 88. They provide for a joint next the curb one inch thick filled two-thirds full of pitch and the top one-third with sand. An inch board is laid along the curb before the brick are laid and within 36 hours after the cement filler is put into the joints this board must be removed and the space filled with pitch and sand.

In vol. xxxiii, p. 391, is a specification for the filler and for placing it. The filler there specified is asphaltic, having 20 parts approved refined asphalt and 3 parts of oil and 100 parts of pitch, both from coal tar, ordinarily numbered 4 at the factory. It must be at least 300 degrees F. when poured and the sand bed and brick must be free from moisture.

Prof. I. O. Baker, in vol. xxviii, p. 239, recommends coal tar No. 6. In vol. xxxi, p. 32, he describes the same coal tar filler and also the Pioneer asphalt filler, which is composed of asphalt not less than 99.5 per cent pure bitumen, composed of not less than 68.3 per cent. petrolene of specific gravity not less than 0.90, and 31.2 per cent. asphaltene of specific gravity not less than 1.13, the specific gravity of the compound being not less than 0.99. The filler is not to begin to melt below 195 degrees nor to run at less than 215 degrees, to be ductile at all ordinary temperatures and not affected by moisture. This is apparently a very detailed and strict specification.

In vol. xxxv, p. 143, coal tar paving cement No. 6 is reported in use as filler in Columbus, O. On p. 281 Mr. W. P. Blair gives details of method of placing and removing boards for providing the space for the pitch filler.

Specifications for Tar Macadam Roads.

Will you please give specifications for tar macadam roads and estimated cost per square yard, stone costing, say $1.15 per ton.

J. D. R., Mayor, ——, Va.

Several articles in the last volume (xxxvii) of MUNICIPAL ENGINEERING give such specifications. They will be found on pp. 109, 130, 143, 254 and 274, with some instructions and reports of experiments. Practice is not yet sufficiently crystallized to make standard specifications or definite estimates of cost. The cost will probably somewhat exceed $1 a square yard for a good road. The article on tests of road materials on another page of this number of MUNICIPAL ENGINEERING gives some instructions as to the construction of tar macadam roads.

Method of Assessing Cost of Street Intersections.

At the present time our city is planning the laying of about forty or fifty blocks of pavement, and I am confronted just now with the question of the manner of making assessments, and according to your invitation, I am writing you for special information concerning the practice in other cities.

The plan of our city is to pave two of the main streets running east and west and to tax the costs thereof to abutting property owners, including the cost of intersections. Now if we tax the costs of the whole intersection to the main streets running east and west, and some time in the future it is planned to pave the streets running north and south and crossing the main streets at right angles, the streets running north and south will not be called upon to pay for any part of paving the intersections on the streets already paved as the paving on those intersections will be already in. What would be your advice in forming some kind of a plan to tax the costs of the intersections to side streets which are not paved? Our statute provides for assessing the costs to abutting property.

E. J. KELLY, Perry, Iowa.

If the statute limits the assessments to abutting property only, there would be an evident injustice in assessing the cost of intersections upon the property abutting on the street only, unless indeed all the lots faced on, say north and south streets and only the sides of the lots abutted on the cross streets.

The method formerly used in Indianapolis assessed the cost of an intersection of two streets upon the property abutting on the streets in all four directions, half the assessment being spread over the property abutting on the street under improvement extending half way from the intersection to the next cross street each way. The other half of the cost of the intersection was assessed on the property abutting on the cross street, from the street under improvement half way to the next street each way. In this way each piece of property that would be interested in the intersection at any time pays its share of its cost at the time the intersection is paved.

If the general funds of the city will permit, the intersections may be paid for by general taxation. There are two principal objections to this method. One is that many cities do not have the money and paving is delayed or stopped if this is required. The other is that many property owners will be paying taxes used to pave intersections of streets far from them and many years before the intersec-

tions in which they are personally interested are paved. This objection is offset in part by the fact that the paving increases the taxable valuation of the city, especially in the paved district and thus relieves the property in unpaved sections of a share of its taxes for all purposes.

Another method of assessing cost of pavements is to divide the area extending back from the street a half block into zones, assessing a large amount per square foot on the first zone, and progressively smaller amounts on the second, third and even fourth and fifth zones. This amounts to about the same thing as the first method described in case the platting of the city is reasonably regular. If there are irregularities it sometimes levies assessments on property not abutting on either the street under improvement or the cross streets. If there is an opportunity to revise the assessments and eliminate inequities incident to the strict application of any rule, either rule will be generally satisfactory, provided some assessment for street intersections can be made legally upon property not abutting on the improved street, but which would receive an assessment for the same were the cross streets improved before or at the same time as the street under consideration.

Macadam Base for Asphalt Pavement.

I would like to know if macadam base has been used successfully under asphalt wearing surface as a substitute for cement concrete and in which manner same has been laid.

H. C. SMITH, Mexico, Mex.

Occasional experiments have been made in this sort of construction but, so far as the writer knows, with indifferent success. Sub-drainage must be perfect and the base must be compact beyond chance of unequal settlement. It must be strong enough to stand any concentration of load which may be brought upon it. These requirements are difficult to attain except at a cost approximating that of a concrete base. Some of them might be attained by using an old, thoroughly compacted macadam street as a base, except that excessive crown and difficulties with drainage are hard to meet. Will our readers report the results of their constructions of this sort if they have any?

Forming Street Surfaces with Irregular Gutters.

McCullough in his excellent work on "Engineering Work in Towns and Small Cities," on p. 334, mentions using gutter summits in cases where street grades are level or nearly so, to improve the flow of water in the gutter, but nothing is said as to methods. I find that to form the irregularity by hand seems tedious and even difficult; false work on the curb, using the same lute as for the regular crown would produce a hollow along the center. I have a couple of places I would like to use the scheme. What is the practical method of producing the irregular shape in brick paving? Our regular crown will be the parabola curve with gutter six inches deep. Your advice will be appreciated.

C. E. V., East Palestine, O.

Can our readers suggest methods of construction?

Perhaps the instrument for setting stakes and computing cuts, which is shown in the department "From Workers in the Field" on a following page would be of assistance. Stakes set by this or some other instrument should aid in getting the concrete properly surfaced. The paper on "Crowns for Pavements" elsewhere in this number will also be of assistance. A standard lute can not be used, for the form of the parabola changes from point to point as the depth of the gutter changes. Probably the depth of gutter will be varied each way from the standard of six inches. The stakes at the quarters and the measurement of ordinates from the crown recommended by Mr. Warren in the article above referred to will probably be the easiest to apply. The parabola differs so little between stakes from the straight line, when the stakes are set as recommended by Mr. Warren, that the surface of the concrete can be located near enough by the use of boards with straight edges long enough to reach between stakes both ways.

When the sand is to be luted, light strips can be laid in the sand, supported in any convenient way, mainly by the sand, and extending from crown to quarter and from quarter to gutter. A straight edge drawn over two of these will level the sand down to the form for rolling. In other words, the luting will be from crown to gutter, rather than parallel to the gutter. Careful setting of the stakes for the concrete so that they can be used in part at least for the luting of the sand will take care of the slight warping of the surface due to the change in the form of the parabola, since the lutes should be straight in the direction of the length of the street and will be used in that position.

Narrowing the Roadways in City Streets.

Kindly let me have some data as to the practicability of narrowing eighty-foot streets with forty-eight-foot driveways to thirty-two-foot driveways. We have a suburban city.

GEORGE HOLMES,
Pres. of Board of Trustees,
Coronado, Cal.

This is a subject which is discussed at some length in many of the reports that have been made recently about improving the appearance of cities. It is also considered in the books on city pavements. The general consensus of opinion is that the roadways should be narrowed to correspond with the traffic over them. The business streets and those with street railway tracks may need 40 to 48-foot driveways, and main lines of travel into the residence districts or out to main country roads, without street car tracks

need 30 to 40-foot driveways. The average residence street has no use for a paved roadway more than 24 to 30 feet wide.

The breadth of view which is claimed as one of the beauties of wide streets, is not interfered with by narrowing the roadway, while the near view of grass, flowers, shrubs and trees is much more acceptable than the bare pavement.

The narrow streets are also far more sanitary. The droppings of horses dry up on the pavement and blow about as dust into houses, vehicles and persons passing, but there are none on the grass plots. The narrow pavements are much easier and cheaper to keep clean and to keep sprinkled, if this treatment is followed, and they are farther from the houses, so that the unsanitary conditions are less pronounced as well as more easily removed.

Trees grow better on the wider grass plots and their number may perhaps be materially increased. Their shade as well as the less area of sun-reflecting hard pavement diminish the temperature, thus adding greatly to comfort.

Then the pavement of the roadway costs in proportion to its area, and a reduction of a third in width means a reduction of a third in cost.

In a city requiring irrigation this is not all clear gain, for the grass, trees, flowers and shrubs must be watered to make them grow.

The uselessness of a wide pavement, the waste of money in building it, the beauty of the area not paved, which can be obtained for the cost of maintaining the pavement, are unanswerable arguments. The writer has never seen an argument in favor of wide pavements except the two suggested above, and has never seen any one who could really convince himself that these arguments were valid when his attention was drawn to their nature.

Salt Lake City, noted for its excessively wide streets, has recently recognized the beauty, utility and economy of narrow pavements. These and the streets of numerous other cities having the same ideas are shown in the volumes of MUNICIPAL ENGINEERING.

Where Are Any Very Large Water Tanks Located?

I should appreciate it very much if you could inform me as to where there have been built in this country any very large water tanks, either of steel or any other construction. We are thinking at present about a tank about 50 feet high and 60 to 80 feet in diameter. Of course just this kind of a tank may not be built, but it would aid in our study of the matter if we could find out about some similar tanks.

A. K. H., City Engineer, ——, Okla.

Can our readers refer our correspondent to any tanks approaching the dimensions named or give him any suggestions as to what they have done on similar problems?

Rattler and Service Tests of Paving Brick.

Can you furnish me with any data showing the relation between rattler and service tests on brick paving block?

E. R. W., Columbus, O.

MUNICIPAL ENGINEERING has published all the data upon this subject, obtained from observations made for this magazine. In vol. xxii, pp. 283 and 363 will be found the fullest data on the subject, being two articles describing rattler tests and observations of wear on test brick pavements laid in Detroit.

Record Forms for Electric Pumping Plant.

Our company has just put in operation an electric pump having a capacity of 5,000 gallons per minute.

Can you give me information about a record book in which to keep account of current used, hours pumped, etc?

W. B. R., ——, Pa.

Can any of our readers supply the desired forms?

Filtering Intake for Water Supply from River.

I thank you for your reply as regards natural filters proposed to be planted in the Ohio river next year for this company. I decided to sink not less than 10 shells, each 6 feet in diameter and 5 feet deep; connecting to either 10 or 12-inch pipes and from them to the regular 18-inch suction pipe 450 feet from the pumps, extreme low water to pump discharge valves 25 feet vertically.

I aim to give ample shell filter area, large suction pipes in them, so that the velocity of the suction in the branch pipes is never lifting sand or gravel, and if they did, I have 200 lbs. per square inch to blow out and settle filled shells, though I do not think for a moment these 6-foot shells will fill with sand. The shells are to be made of 5/8-inch steel, steel heads lighter to handle, and well painted with red lead will last forever.

All the shells will be set in 2 feet of 1-inch gravel, specially filled in cofferdam, gravel to be at least 6 inches above bottom of shells, then 5 feet of coarse sand, and fo r the finish 2 feet of gravel to fill to regular surface of river bottom. The cofferdam will be excavated to a large area, at least 40x70 feet, thus giving ample filter surface for the shells. We have not found the depth of coarse sand by probing with pipes. No doubt the sand is not less than 25 feet in depth. The suction pipe with all the shell connections and shells will rest on a number of light oak piles, so no settling or springing of the flanged pipe joints can take place. All the 450 feet of 18-inch suction pipe will be cast iron, or smooth inside 5/16-inch steel pipe, in tunnel where no heavy short joints can be accommodated. The suction pipe of old strainer system now in use will be left in place, branched to the new suction pipe, operated by 2 18-inch gate valves which are in a laying position to avoid air pockets. The 18-inch valves to be operated from a tower near pump house (110 feet). This is now the plan for the 2-million system, and I expect to get full supply of 2 million from 10 wells, and if necessary can put more shells at end of suction, should there be a shortage.

Is there anything here that is not feasible or practicable? The only thing I alway was afraid of was the 25-foot suction lift and 450 feet of a pull to pumps, but

in this extreme low water I can run old strainer system temporarily until the river rises.

By the way, the excavation of cofferdam will be 12 feet. I will want to rent 16-foot sheet piles, 220 feet lineal. I also may need a lot of short sheet piles about 10 feet long.

A. S., ——, Ky.

Suggestions from our readers will be printed if sent to the editor.

There seems to be a patent on a method of getting water from a river bed quite similar in its general features to the plan described, which is in use in a West Virginia town on the Ohio river.

Information about the sheet piling will also be welcome.

Books on Dry Closets and Country House Sanitation.

We wish to know what books there are on dry closets and sanitary country houses.

G. & M., Fargo, N. D.

Gerhard's "Sanitation, Water Supply and Sewage Disposal of Country Houses" ($2), and Bashore's "Sanitation of a Country House" ($1) are books on the latter subject. The best treatment of the dry closet in an American book is found in a chapter of Chapin's "Municipal Sanitation in the United States" ($5).

Books on Landscape Gardening—Card Index for Engineer's Office.

Can you refer me to any source where I may procure text-books on landscape gardening or landscape architecture? Have you any references pertaining to forms for card index for an engineers office?

J. C. C., Watertown, S. D.

The following are the books on landscape gardening, of which there have been several new ones recently published:

Repton's "The Art of Landscape Gardening" ($3.22) a new edition edited by John Nolen of two old English books.

Parson's "Landscape Gardening" ($2).

Maynard's "Landscape Gardening" ($1.50).

Lowell's "American Gardens" ($7.50).

Kellaway's "How to Lay Out Suburban Home Grounds" ($2).

Ferree's "American Estates and Gardens" ($10).

There have been some good articles on methods of indexing engineer's records in MUNICIPAL ENGINEERING, in vol. xxxviii, p. 56; vol. xxx, p. 409; vol. viii, p. 236.

Another good article will be found in the *Journal of the Association of Engineering Societies*, vol. xliii, p. 111, and one on the filing system in Salt Lake City, in vol. xliv, p. 72.

Who Sells Natural Red Chalk?

Who deals in, and where can I get "Red Chalk" (Ruddle) in its natural form in bulk, just as produced from the earth? Where is the best natural product found, for marking engineers' stakes? Can you give names of some dealers in this kind of chalk? I have tried some from a St. Louis firm, but the stuff was altogether too hard to use on wood, and rather too light in color.

L. C. H., Bellingham, Wash.

Can our readers give any information about the natural product?

Carrying Capacity of Cement Floor.

I would like to know the carrying capacity of a cement floor 8 inches thick. Mixture: 1 cement, 2 sand, 3 stone. The floor to be built on a well-packed cinder bed.

H. F. S., Napoleon, O.

If the load is distributed over the whole area of the floor, the load will be limited by the carrying capacity of the earth under it. This can be determined approximately by the principles upon which the breadth of foundations are computed with a knowledge of the character of the material upon which the foundation rests.

Should the loads be concentrated, the crushing strength of the concrete as determined by tests of cubes will certainly be safe if applied to the larger and far better supported volume of the concrete floor. Various mixtures run from, say 800 to 4,000 or more pounds per square inch. Unless the sub-foundation is insufficient, as determined by the same method suggested above, using the area on which the load is concentrated plus an area about 8 inches wide all round outside the area covered by the load. Safe loads on various earths are, say 2 tons per square foot for clay and sand and one-half ton for soils, with increase of 100 to 200 per cent. under specially favorable circumstances. Gravel and coarse sand, well cemented and confined, will carry 8 to 10 tons per square foot.

The cinder bed would not be as strong as the compact gravel foundation. Say one ton per square foot would probably be safe for any probable foundation, with material increase for more favorable foundations.

Canadian Cement Merger.

We have been given to understand that the Canada Cement Company, Ltd., with offices in Montreal, P. Q., has taken over a large number of the cement mills in Canada, and these have all been united under one management, with the foregoing name. This is not brought out in your fifth edition of your "Directory of American Cement Industries." We would very much appreciate your sending us, if you have the data at hand, this desired information.

P. B. G., Rochester, N. Y.

The combinations of Canadian cement companies have been made since the fifth edition of the "Directory of American Cement Industries" ($5) was issued. The Canada Cement Co., Ltd., Montreal, Que., has been formed to take over the following companies:

Alberta Portland Cement Co., Calgary, Alberta.

Belleville Portland Cement Co., Belleville, Ont.

Canadian Portland Cement Co., Toronto, Maribank and Port Colborne, Ont.

International Portland Cement Co., Ottawa, Ont., and Hull, Que.

Lakefield Portland Cement Co., Montreal, Que., and Lakefield, Ont.

Lehigh Portland Cement Co., Belleville, Ont.

Owen Sound Portland Cement Co., Owen Sound and Shallow Lake, Ont.

Vulcan Portland Cement Co., Montreal and Longue Point, Que.

It is proposed to acquire also the Western Canada Cement and Coal Co., Exshaw, Alberta, and the Eastern Canada Portland Cement Co., of Quebec, not yet established.

The following directors of the new company are officials in one or more, some of them in as many as three, of the above named companies: Sir Sanford Fleming, J. M. Kilbourn, J. S. Irvin, W. D. Matthews, Robert W. Kelly, William R. Warren, W. H. E. Bravender, E. M. Young.

Other directors are: J. R. Booth, Geo. E. Drummond, W. C. Edwards, Robert Mackay, G. A. Cox, W. M. Aitken, C. H. Cahan.

Another cement combination is reported to be in process of formation by J. R. Roaf of Toronto, Ont., to be known as the Independent Portland Cement Co. The following companies are reported to have agreed to enter the combination:

Bells' Lake Cement Co., Markdale, Ont., proposed plant.

Brant Portland Cement Co., Brantford, Ont., proposed plant.

Colonial Portland Cement Co., Wiarton, whose affairs are being wound up by the courts.

Hanover Portland Cement Co., Hanover, Ont.

Imperial Cement Co., Owen Sound, Ont.

Ontario Portland Cement Co., Brantford and Blue Lake, Ont.

St. Marys Portland Cement Co., St. Marys, Ont., proposed plant.

Superior Portland Cement Co., Orangeville, Ont.

Western Ontario Portland Cement Co., now known as the Maple Leaf Portland Cement Co., Atwood, Ont.

This leaves the following companies independent:

Edmonton Cement Co., organization under consideration.

Rocky Mountains Cement Co., Calgary, Alberta, under construction at Blairmore.

Vancouver Portland Cement Co., Vancouver and Tod Inlet, in operation.

Commercial Cement Co., Ltd., Winnipeg and Babcock, Manitoba, in operation.

Portland Cement Co., Winnipeg and Conor, Manitoba, proposed plant.

Sydney Cement Co., Sydney, Nova Scotia, puzzolan plant in operation.

Ben Allan Portland Cement Co., proposed plant near Owen Sound, Ont.

National Portland Cement Co., Durham, Ont., in operation.

Nova Scotia Cement and Plaster Co., Toronto, incorporated.

Sun Portland Cement Co., Owen Sound, Ont., in operation.

Toronto Lime Co., Limehouse, Ont., natural cement.

Isaac Usher, Queenstown, Ont., natural cement.

There is also the Portland Cement Company of Canada, Quebec, Que., which seems to be a sales agency.

The Concrete Industry in the West.

Will you please send me information you may have of the cement industry in Oregon and Washington? I have been thinking of locating in the west, and if you can tell me anything about this line I will be obliged to you. I am a contractor at this place, doing general concrete work of all description. Can you tell me the general price paid for cement per bbl., also other materials and the prices paid to the contractors for the work in that section of the country? I am a subscriber of your "Directory of American Cement Industries."

C. L. S., ——, Pa.

Will our readers send us some special information for the benefit of our correspondent?

There are numerous brands of cement made on the West Coast and many other imported and eastern cements are in use there. Full information about them will be found in the "Directory of American Cement Industries" ($5). Reference should be made to the "Geographical List of Cement Manufacturers" under the states of California, Colorado, Idaho, Montana, Oregon, Utah and Washington for names of present and proposed cement plants. Cements from Kansas and Pennsylvania will be found on the market also, and foreign cements from Belgium, England, Germany, Canada and Japan, as well as such special products as white Portland cement and bricklayers' cement from the central states. Local Seattle market reports show steady quotations of $2.20 a barrel for West Coast cements, sacks extra; $2.70 for Eastern cements, sacks extra; $2.75 for foreign cements, and $2 for bricklayers' cement. Lime is quoted at $1.60 to $1.65 a barrel according to quality; common brick, $9.50 a thousand; paving brick, $20; common dimension lumber and shiplap, $14 per M.; reinforcing bars, 2¾ to 3½ cents a pound; pig iron, American, $22.50, English, $25 to $26 a ton; crushed marble and granite, $20 a ton; gravel and sand, 80 cents a cubic yard.

Recent paving bids in Seattle ran from 30 to 60 cents a cubic yard for sub-grading; $1.43 to $1.70 a linear foot for straight granite curb; 31½ to 35 cents a linear foot for concrete curb; 55 to 75 cents a linear foot for armored curved concrete curb; $1.50 to $1.70 a square yard for asphalt paving on concrete base; $3.50 to $3.90 for sandstone block paving; $1.20 to $1.50 for concrete alley crossing; $1 to $1.20 a square yard for concrete sidewalk; $7 to $8 a cubic yard for concrete wall.

In other cities concrete paving costs $1.50 to $2.83 a square yard, according to quality; asphalt, $1.50 to $1.85; brick, $2.80; bitulithic, $2 a square yard; cement sidewalk, 15½ cents a square foot; building macadam road, $1.74½ a cubic yard.

Seattle sewer bids run $2.50 to $3.15 a linear foot for 15-inch pipe; $4 to $5.40 for 24-inch pipe; $6.25 to $11.75 for 36-inch brick sewer; $10.55 to $13.15 for 48-inch reinforced concrete sewer; $11.70 to $13 for 54-inch; $12 to $18 for 60-inch, according to difference in specifications; $20 to $24.25 for 72-inch reinforced concrete sewer; extra concrete, $8 to $12 a cubic yard; extra steel, 5 to 6 cents a pound.

On a water works reservoir in Portland, Ore., prices on two contracts varied for earth excavation from 24 to 66½ cents a cubic yard; concrete, $7.80 to $12.75 for Class A and B and $6.65 to $12 a cubic yard for Class C; concrete walk, $1 to $1.50 a square yard; steel reinforcement, 3½ to 6 cents a pound.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

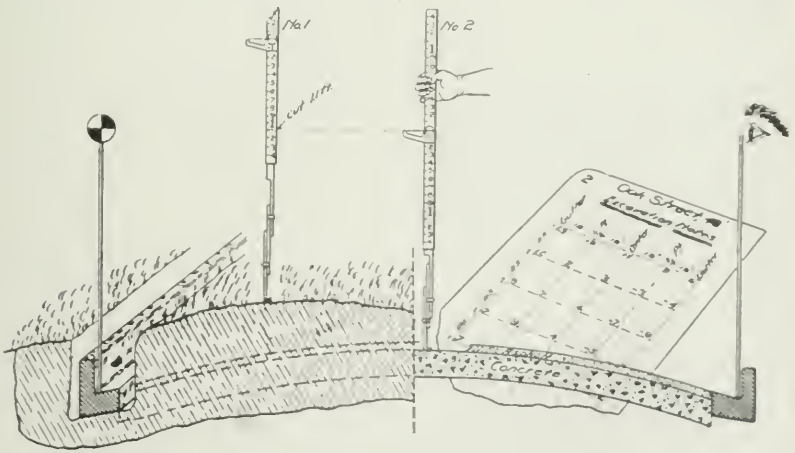
Crowning Instrument and Excavation Calculator.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The accompanying cut shows a crowning instrument and excavation calculator, invented by me. The instrument of the common type will construct any crown of pavement from 0 to 14 inches, and will calculate any depth of cut or fill from 0 to 18 inches. These may be increased by special construction.

In using the instrument the curb and gutter, or curb, is first constructed, which is usually contracted including excavation. Then targets are set up in the gutters, the eye sighting over one to the other. Position No. 2 shows the operator giving grade for concrete at crown or center of pavement. Position No. 1 shows the amount of cut at the ¼ point, the eye reading 1.1 ft. direct without any figuring. The left half of the picture is a section of the isometrical view of a street with curb and gutter constructed. The right half shows a cross-section of the pavement with a leaf from the note book showing the simplicity of excavation notes, the positive numerals indicating cut and the minus numerals fill. The instrument can be used on the most complex crowns as readily as on the simple ones. O. E. NOBLE, City Engineer,

Hobart, Okla.



Report of the Indianapolis Municipal Asphalt Repair Plant for 1909.

To the Editor of MUNICIPAL ENGINEERING:

Sir—During the year 1909, from January 1 to December 31 inclusive, there were turned out by the Indianapolis municipal asphalt plant 14,344 boxes surface mixture, 416 boxes cushion and 327 boxes binder, a total of 15,087 boxes of mixture turned out in this period.

There was expended for automobile, brick testing machine and extra sheds, $939.01.

The repairs covered more than sixty different streets, and some of the streets have been almost resurfaced, as in the case of West New York street, from Blake to West, and Kentucky avenue from West to Oliver avenue, on both of which there has been a heavy hauling of gravel and which was almost impossible to keep in repair before installation of this plant. On several other streets the repairs were extensive, but by our method of joining on to our former patches, the streets will eventually be re-surfaced, and the old-water-soaked and lifeless material will be replaced with first-class material.

There were 1,300.14 sq. yds. of concrete laid by this department on the private work done for plumbers and public service corporations.

There were also done by this department the necessary grading and 2,061 sq. yds. 4-inch Portland cement concrete, and 2,061 sq. yds. of brick paving, also 972 sq. yds. 4-inch concrete, 972 sq. yds. 1-inch binder and 972 sq. yds. 1½-inch asphalt surface on the driveways of the City Hospital; as well as 705 lin. ft. circular curb (cement), 472 lin. ft. straight curb (cement), 9,873 sq. ft. of cement walks and courts, 120 ft. of sewer connections for catchbasins, three catchbasins and a cement garbage platform 8 ft. x 14 ft. x 4 ft. 4 in. high. This hospital work was from a special appropriation for the work and cost $8,434.81.

On January 1, 1910, there was on hand and paid for sand, asphalt, coal, limestone dust, fluxing oil and other materials costing $793.63.

The total amount of private work last season amounted to 8,743.87 sq. yds., and the money paid or due the city controller for this work amounts to $16,371.40, for which amount our fund should be credited.

There was appropriated for the street repairs, asphalt plant and maintenance fund during the year $63,000, added to which the material on hand January 1, 1909, $2,321.88, gave a total amount of $65,321.88 available during the year. There was a balance unused of this fund of $18.88.

The total cost of all work done exclusive of the hospital work, which was separate, was $65,720.02 for 79,003 sq. yds., or 83 cents per square yard. This includes interest on investment of $21,469.69 for the year at 5 per cent and depreciation at the same rate, also the cost of concrete necessary on private work.

Deducting $16,371.40 money received or due for private work, also cost of concrete work on private work $1,300.14, would leave the actual cost of the city's own repairs to be $48,048.48 for 70,259.5 sq. yds., or 68 cents per square yard. This includes all expense attached to work, superintendence, interest on total investment, depreciation on plant, rollers and tools, and insurance, lease on grounds, also extra cost of binder or cushion where needed to bring foundation up to within 2 inches of the street.

The work was extended over the whole year, so as not to allow the holes to become too large, and was done on the eight-hour basis, same as other city work, and the season was what would be called by the contractors a wet paving season.

Maltha California asphalt at $23.80 per ton was used, with either petroleum residuum or Indian river asphaltic base oil as a fluxing agent, and the best of labor and material used throughout, thus insuring first-class work.

Altogether there was turned out by this plant 14,344 boxes of surface, 416 boxes cushion and 327 boxes of binder, a total of 15,187 boxes of mixture, and no delays of any kind were occasioned by the plant.

	Asphalt Surface.
Actual city repairs	70,259.50 sq. yds.
Private	8,743.87 sq. yds.
	79,003.37 sq. yds.
Hospital driveways	972.00 sq. yds.
	79,975.37 sq. yds.

Also 200 sq. yds. binder, making a total of 80,175.27 sq. yds. of surface and binder turned out by this plant and laid during this year, also 1,300.14 sq. yds. concrete.

Automobile, extra sheds, brick rattler	$939.01
Concrete	1,300.14
Private work	16,371.40
Material on hand Jan. 1, 1910	793.63
Balance fund on hand	18.88
City's own repairs (cost)	48,048.48
	$67,471.54
Fund appropriated	$63,000.00
Interest and depreciation for 12 months @ 10 per cent	2,149.66
Material on hand Jan. 1, 1909	2,321.88
	$67,471.54

SAM R. MURRAY,
Superintendent of Asphalt Plant,
Indianapolis, Ind.

Pavements for Hot, Dry Climate.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We notice in your December issue, page 395, an inquiry from Phoenix, Arizona, under the heading "Pavements for Hot, Dry Climate," signed "T. J. P., Phoenix, Arizona." In reply you stated "Bitulithic pavement has been used in the South, but perhaps is not as hot and dry a climate as Phoenix." Large areas of Bitu-

lithic pavement have been laid throughout the South, particularly in Texas, and the City of El Paso alone has been using bitulithic pavement for the last four years and now has 270,000 square yards in use. El Paso has an extremely hot and dry climate with practically no shade.

GEO. C. WARREN,
President of Warren Brothers Company,
Boston, Mass.

MUNICIPAL MATTERS IN COURT

Higher Courts——Memphis Charter—New Jersey Water—Sewer Decisions

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY AT LAW, INDIANAPOLIS, IND.

Vacation of One Side of Street—City's Liability to Property Owners on Other Side.—Where a street was laid out on a city plan, on both sides of a railroad, but not across the right of way, there being a mere permissive crossing, the vacation of a portion of the street on one side of the railroad did not render the city liable for damages to owners of property abutting on the street on the other side, especially in the absence of proof that the crossing on the vacated side joined any well-defined road corresponding at any time with the platted lines of the street on that side.—Siddal v. City of Philadelphia, 73 A. 1013, 225 Pa. 55.

Water Area Included Within City Boundaries.—It was not error to hold that the water area within the boundaries of a proposed village should be included as a part of the one-half square mile, which by St. 1898, Sec. 854, a village proposed to be incorporated must cover, and such ruling was not tantamount to a holding that no village should be incorporated which bordered on a large body of water, for the incorporators were not obliged to include the water area, and, furthermore, there is no limitation placed upon the area of a village by statute further than to prevent the entire town or towns being included.—Fenton v. Ryan (Wis.), 122 N. W. 726.

Dismissal of City Officer by Mayor—Limitations of Power.—Laws 1885, p. 1251, c. 378, establishing a fire and police commission, vested in the commission the appointment and removal of the chiefs of the fire and police departments, but section 11 provided that the chief of police and the chief of the fire department etc., should be subject to suspension from office for cause by the mayor at any time pending charges by the commission. *Held*, That the power of suspension was discretionary in a high degree, permitting the mayor to look not only to the charges, but to the necessities of the community, and his decision not to exercise the power in a given case was not subject to review or direction by the courts where there was not an entire refusal to consider and exercise discretion.—State v. Rose (Wis.), 122 N. W. 751.

Council Member's Agreement to Secure Contract with City—Grounds for Expulsion—Right to be Heard in Defense.—A city council member, who agreed for a consideration to aid in securing a valuable contract with the city and to secure an increase in the appropriation to unduly increase the profits, was guilty both of disorderly behavior and malconduct (misconduct) in office within Gen. St. 1906, Sec. 1012, authorizing an expulsion therefor * * * * such council member, or any officer of a city should be given an opportunity to be heard in defense of any charge against him for which he may be expelled.—Etzler v. Brown (Fla.), 50 So. 416.

Street Improvement Assessment Does Not Extend to County Courthouse Square.—Under a system of county and municipal government, statutory authority given a city to impose a street improvement assessment will be held not to extend to a county courthouse square, unless an intent to include such property clearly appears.—Edwards v. City of Ocala (Fla.), 50 So. 421.

City Liable in Private Capacity for Negligence in Operation of Municipal Water Works Plant.—Where a city maintained water works for public and private use under the control of a board of commissioners, who employed a superintendent and such a agents and servants as were required, the revenue being applied to the cost of construction, operation and maintenance, the city in so doing acted in a private and not in a gov-

ernmental capacity, and was therefore liable for injuries to a citizen by the negligence of its servants in charge of the water works resulting in the flooding of his premises.—Piper v. City of Madison (Wis.), 122 N. W. 730.

Compensation of City Attorney—Recovery in Excess of Salary Must be Based upon Special Employment.—Under a village ordinance, fixing at a specified amount the annual compensation of the village attorney, and providing that in certain cases such attorney shall be allowed the usual fees of "attorneys practicing in such courts" besides the amount fixed as his salary, the attorney can not recover for his services during the year of his appointment a sum in excess of the amount so fixed, in the absence of any record showing a special employment by the village board in one or more of the cases mentioned.—McGorney v. Village of Melrose Park, 89 N. E. 264, 241 Ill. 142.

Amendment of Ordinance to Conform to Statute.—An ordinance of a city of the second class imposing a penalty of $200 for carrying on the business of a pawnbroker without a license may be amended so as to reduce the penalty to $100, and thus make it conform to Act March 7, 1901 (P. L. 20), granting cities of its class the power to enforce all ordinances by inflicting penalties for violation not to exceed $100 for any offense.—City of Scranton v. Engel, 39 Pa. Super. Ct. 534.

Improvement of Streets Abutting on County Property.—The statutes do not authorize a city to improve the streets abutting on county property at the expense of the county, in the absence of a contract on its part to pay therefor.—Edwards v. City of Ocala (Fla.), 50 So. 421.

Improvement of County Property.—The authority to improve county property is by statute given the county commissioners alone and can not be directly or indirectly exercised by a city.—id.

Predetermination of Cost of Improvement—Change in Specifications—Paid for as Extra Work.—Where the nature of a public improvement permits a predetermination of its actual cost, it should be determined by the city council, but a provision in sewer specifications that if, in the judgment of the city engineer it shall be necessary to form any part of the foundation of the sewer of concrete, it shall be paid for as extra work, was not void as giving the city engineer discretionary power to vary the cost of the work.—McCaleb v. Dreyfus (Col.), 103 P. 924.

Conditional Signature Invalidates Petition for Improvement.—Where a property owner wrote the word "conditionally," after his signature to a petition for the paving of a portion of a street, without specifying what the condition was, the property could not be counted in determining whether the petition was signed by the owners of the requisite two-thirds of the frontage; any condition invalidating such a signature.—Newton v. Borough of Emporium, 73 A. 984, 225 Pa. 17.

Partial Vacation of Street—Abutting Owner Entitled to Special Damages—Injunction.—An owner of lots abutting a portion of a street narrowed and partially vacated as the result of a proposed replot suffered special damages different in kind from that suffered by the community at large, and was therefore entitled to sue for an injunction restraining such vacation.—Brazell v. City of Seattle (Wash.), 104 P. 155.

Tax Levy to Maintain Municipal Water Plant Objected to by Private Water Works Company as a Discrimination.—A village applied to the State Water Supply Commission for approval of plans for municipal water works, stating therein that the village would purchase at a fair price the existing water works system of defendant company. The application was granted, but the proposition to purchase defendant's plant was lost on submission to the voters. A part of the village tax was levied to maintain the municipal water works system, and defendant objected to the levy of any part thereof against its property in the village, claiming that such tax would discriminate in favor of the municipal water plant. *Held,* That as the village had jurisdiction of the defendant's property the tax was not void.—In re Beauty Spring Water Co. 118 N. Y. S. 659.

Questions of Bond Issues for Water Works and Sewerage Must be Separately Submitted to Voters.—Under the statutes authorizing the issuance of municipal bonds on the voters voting therefor, water works and sewerage are distinct propositions, and must be separately submitted to the voters, and there is no legal authority for the issuance of bonds to enlarge a water works system and add a system of sewerage submitted to the voters as one proposition.—Chase v. Gilbert (S. C.), 65 S. E. 735.

Constitutionality of Memphis Charter Attacked.

In a suit filed January 1 by several citizens of Memphis, Tenn., the constitutionality of the new charter of that city, creating a commission form of government, which became operative at midnight December 31, was attacked. The suit was filed in the chancery court against Mayor E. H. Crump and the four commissioners, alleging that the new charter takes away the right of self-government and gives to the commissioners despotic powers.

Contest Over New Jersey City Water Supply.

Arguments were heard by Vice-Chancellor Stevens, January 18, on the return of a rule to show cause in the proceedings brought by Newark, the East Jersey Water Company and the Jersey Water Supply Company on three separate bills,

to enjoin suits at law brought by the Chestnut Hill Land Company to recover damages for the diversion of water from the Passaic river. The bills of the complainants allege that the damage done to the defendant land company, if any, is chiefly, if not entirely, caused by the discharge of sewage into the river by Paterson. The bills further allege that the Passaic Water Company diverts water for the use of Paterson under legislative authority; that the Acquackanonk Water Company diverts water for the city of Passaic by legislative authority and prescriptive right, while the Montclair Water Company, the Jersey City Water Supply Company and the East Jersey Water Company divert water for the imperative uses of municipalities and under legislative authority.

Decisions in Sewer Cases.

At Bloomington, Ind., Judge Wilson rendered a decision Jan. 21 dissolving the temporary injunction in the sewer assessment cases in this city. This means that the original assessments of the city council will stand, and that the city treasurer may sell the property at public sale on which the tax is delinquent.

In an opinion submitted by Attorney-General O'Malley, at Albany, N. Y., Jan. 20, the rights of the state commissioner of health to prohibit the discharge of sewage into any waters of the state are defined. The attorney-general points out that the statute specifically provides that suits to restrain violations of this law, or for penalties prescribed, are to be brought by the local board of health. He also holds that the law applies to Greater New York the same as to all other cities and villages whose sewers drain into state waters.

Indiana Road Laws are Valid.

The Indiana Supreme Court has reversed its decisions with reference to the constitutionality of the gravel road and the "three mile road" laws passed by the legislature. The questions were concerning the construction of laws in which mistakes in wording had occurred, and further consideration caused the court to modify the decision made a few weeks ago and declare the laws valid. Millions of dollars of bonds issued for work completed and under construction and of work in prospect, jeopardized by the former decision, have been made safe.

CURRENT INFORMATION

Park Funds—Everett Salaries—Niagara National Park—City Plan Commission—Municipal Light for Bloomfield—Fire Alarm Transmission—Inspection of Work by Commercial Association—Pavement Assessments

St. Louis Civic League on Park Funds.

The Civic League of St. Louis, Mo., has decided that the system of establishing parks in that city is radically wrong, and the members will endeavor to have it changed with the charter. Under the present system parks are paid for and maintained out of the general fund. All residents of the city have to pay a portion of the cost, whether the parks are adjacent to their property, or whether they will ever derive any use from them.

The Civic League will try to change this, and will advocate a special assessment plan or a bond issue. A park commission of five men will be recommended, and will have charge of all parks, boulevards, public playgrounds, athletic fields, museums, baths, etc.

The league's committee report, which embodies the revolutionary recommendations, was adopted by the executive board of the league.

Contest Over Everett's Official Salaries.

As a rebuke to Mayor C. A. Bruce, of Everett, Mass., who vetoed an order placing the members of both branches of the municipal government on salary, the board of aldermen of that city voted, December 29, to abolish the mayor's salary. In vetoing this order, Mayor Bruce stated that the city was too poor to grant the salaries. The aldermen retaliated by saying that if the mayor's contention is true, the city is also too poor to allow the mayor an annual salary of $1200. Mayor Bruce claims that the action of the aldermen can not be sustained.

Houston, Tex., Proposes Assessment of Abutting Property for Pavements.

Petitions are being circulated at Houston, Texas, requesting the city commissioners to call an election to determine whether the plan of assessing abutting property owners for permanent street pavements, as provided for by an act of the last legislature, shall be adopted. The plan proposed in the petition is to assess two-thirds of the cost of pavements against abutting property owners and one-third against the city. The city officials approve of the proposition, and, it is stated, the plan has met with the approval

of citizens in cities where it has been adopted.

National Park for Niagara.

The committee of landscape architects recommends, in its report to congress, the creation of a national park at Niagara Falls. The committee urges that a strip of property be acquired by the United States connecting with the state reservation of the gorge, embracing the Talus, the Cliff and a tract of land not less than 100 yards wide, to be converted into a national reservation.

City Plan Commission Proposed for Newark, N. J.

In his third annual message to the common council, January 7, Mayor Jacob Haussling, of Newark, N. J., embodied a suggestion for the creation of a city planning commission, whose functions would be similar in nature to certain of those now vested in the board of works. In fact, the establishment if such a commission would result in relieving the board of works from some of its duties. He also urged conservatism in proposed policies involving bond issues, so far as the progressive spirit will permit.

Municipal Light Proposed for Bloomfield, N. J.

The purchase of the electric light and power equipment of the Public Service Corporation now supplying the town of Bloomfield, N. J., and use of it to convey current obtained from some municipal plant, if possible, is recommended by Mayor Sutphen, in his annual message to the town council. The town has the option, under the terms of the fifteen-year franchise granted the lighting company and which expires next year, of buying the plant. The five-year contract to light the town ends almost simultaneously with the franchise, and it is because of this fact that the mayor suggests the establishment of an illuminating department.

Transmission of Fire Alarms in Rochester.

In his annual report, submitted January 7, Charles Little, chief of the fire department of Rochester, N. Y., showed that during 1909 1,063 fire alarms were sent to the department from various sources. Of this number nearly half, or 515 alarms, were transmitted over the Gamewell fire alarm system, and 28 alarms were sent over the Standard system. The telephone played a prominent part in the delivery of fire alarms, as 432 calls for apparatus were turned into headquarters, and in addition there were 88 verbal calls to the firemen in the various fire houses.

Inspection of Public Works by Commercial Association.

The Merchants' Association of San Francisco, Cal., established a bureau of inspection, taking over on November 1 the work heretofore performed by a committee of the civic league. It is in charge of Henry A. Campbell as engineer, with D. A. Hagens as financial secretary and auditor, and seven or more office and field assistants. It is largely supported by popular subscription. The first report, for the month of November, 1909, has been printed and demonstrates the value of the service by its story of errors corrected and abuses exposed.

New Jersey to Prevent Exportation of Water from State.

In its third annual report the New Jersey Water Supply Commission asks the Governor to recommend to the legislature the passage of acts which will effectually prevent the transmission out of the state of sub-surface or underground waters, and to place them under the jurisdiction of the commission to the end that these resources of the state may be conserved for the use of the cities of the state.

MUNICIPAL AND TECHNICAL LITERATURE

Oakland Street Plans Are Modern—Rochester Asphalt Repairs—Municipal Reports

Oakland Street Plans Are Modern.

The Oakland, Cal., street department, under the supervision of Street Superintendent Walter C. Howe, has completed one of the busiest and most satisfactory years in the history of the municipality.

Early in July, 1909, at the request of the street superintendent, the board of works reorganized the street department, in so far as the employment of labor was concerned. An ordinance was passed by the council limiting the number of street laborers and other employes and providing for their continuous employment throughout the year. Under the new system, the street department is able to give continuous service and in consequence the amount of work accomplished is greater

and the efficiency of the department much enhanced.

The inspection of new construction work on paved streets, sewers and culverts as now carried on by the Oakland Street Department is very creditable. The desire of the Board of Works and the street superintendent has been to appoint only competent and efficient men upon this most important feature of public work. In consequence, the department has quietly gathered together a corps of both practical and technically trained men, whose duties are to see that the specifications covering the work upon which they are detailed are carried out to the letter. This condition has given an added stimulus to paving work throughout the city.

Many property owners are by nature skeptical of the integrity of all public work, no matter how good the reputation of the contracting firm doing the work. Assured, however, of honest and capable inspection of the materials and workmanship upon the job the results are a source of satisfaction to the property owners, the contractor and the city.

The Street Department has recently established at the city corporation yard a testing laboratory. A standard rattler has been installed, by means of which the rock placed upon any street in the city may be first tested for loss by impact and abrasion and its relative value as a paving material determined. Vitrified brick and blocks laid by the Traction Company, steam railroads or by the city are also subjected to the rattler test.

All cement used upon concrete sewers, street paving foundations, culverts and similar work is first subjected to test at the laboratory and records of such tests are filed for reference.

The laboratory is equipped with a Dow penetration machine and other equipment for making tests of asphaltic cement used in the standard asphalt paving mixtures. Other necessary tests essential to good work are made.

The laboratory is a source of much satisfaction to the Street Department, as it gives opportunity for the study of different classes of paving mixtures and paving materials; a knowledge of just what is going into the work and the chance to determine the actual value of these materials when subjected to different kinds of traffic. The data taken at the laboratory will be of incalculable value to future street superintendents.

On January 13, 1909, the Board of Works, upon recommendation of Superintendent of Streets Howe, adopted a map outlining an area within the heart of the city to be hereafter paved only with permanent pavements, i. e. standard asphalt, vitrified brick, basalt block, bituminous rock, asphalt macadam, etc. The action of the board was ratified by the City Council and in consequence the old macadam streets, with their intolerable dust in summer and mud and slush in winter, will in a few years be a thing of the past in the district lying between Market and Fulton streets, Water street and Twenty-second street. This has been one of the most important moves made by the administration in many years, in an effort toward a modern and properly paved municipality.

While it is the future policy of the city engineer and the Street Department to recommend plain macadam upon streets where property values are low and where the section is sparsely settled, these departments intend to substitute oiled macadam for plain macadam wherever possible. The cost of the oiled macadam is approximately from 3c to 5c higher per square foot, but it makes a far more satisfactory street and if the road material is properly laid and impregnated with a heavy road oil, having an asphaltum base of from 70 per cent to 80 per cent, the finished street is more elegant to the eye, is free from dust and a money saver on water and labor for sprinkling.

Wooden curbing is to give way to plain concrete, reinforced concrete or granite curbing in future street work, except in special cases, as in filled ground or upon streets and roads in the newly annexed districts, where habitation is scarce and values of property low.

An ordinance has been recommended to the City Council in accordance with the above. This means that throughout the residential districts of Oakland, concrete curbs and gutters will soon replace unsightly (and in many instances) dry rotted and broken wooden curbs.

The first vitrified brick ever laid in Oakland now adorn the Oakland Traction Company's rails on Piedmont avenue. These brick were brought from Los Angeles for the purpose. An ordinance has recently been approved and adopted by the Council at the suggestion of Mayor Mott and the street superintendent, compelling all street railways and steam roads to tooth their rails with basalt blocks, vitrified brick or special blocks. These are to be laid on concrete, which concrete must extend to the depth of each tie. Rigidity is thus obtained and the blocks remain in place. The effect of this toothing is to give a more finished appearance to the street and to obviate the now almost continual state of disintegration of pavements alongside of car tracks. The concrete between ties will give a solid foundation for the pavement to be installed and overcome the tendency of the finished pavement to settle in the space between the ties, due very often to lack of foundation.

Rochester Asphalt Repairs.

During 1909 the city of Rochester, N. Y., expended $47,278 for repairs to asphalt

pavements on which the guarantee limits had expired. The amount of pavement repaired aggregated 37,703 square yards and cost $1.23 a square yard.

Municipal Reports.

Annual Reports of the City Engineer of Minneapolis, Minn., 1907, 1908. Andrew Rinker, City Engineer.

The two reports for the two years come in the same envelope and are prepared on the same plan so that comparisons are easy. The two historical sketches are evidently prepared by different persons without comparison of results, for they give different incidents in great measure and differ in details and in dates where the same occurrences happen to be mentioned. The contemporary history given in the figures of the report is more closely in agreement.

The total expenditures in each of the two years are practically the same, the $1,717,433, of 1908 being only $137,000 more than 1907. The inventory of permanent public improvements made under the city engineers' department now amounts to $20,646,101, of which over 5 million was spent for pavements, over 6 million for sewers, over 6 million for water works and 2¾ millions for bridges. The municipal subway is put down at $14,000 and the crematory at $25,812.

Records are kept of traffic on the test wooden block pavement on Nicollet Ave. Observations were made on 19 days in 1907, three with snow on the ground, and on 12 days in 1907, two with snow on the ground. The traffic is classified as light and loaded, 1, 2 and 4 horse, rubber and steel tires and number of vehicles and tonnage is given. The number and tonnage of horses, bicycles and automobiles is also given, and a supplementary item gives the number of teams trotting and the number walking. The average tonnage, assuming traffic to be all on 25 feet of the width of the street, was 254 in 1907 and 268 in 1908.

One diagram shows the variation in popularity of the various paving materials. Beginning in 1881 cedar block of the old round form increased rapidly in mileage to 81 miles in 1894, and, with a sharp turn has diminished almost as rapidly to 9 miles in 1908. Granite, beginning in 1881 increased to 7½ miles in 1887, to 10 miles in 1893 to 1903 and to 18 miles in 1908. Asphalt, beginning in 1887, increased gradually to 5 miles in 1895, to 11 miles in 1896 and 13 miles in 1902 and decreased to 10 miles in 1908. Macadam, beginning in 1894 increased to 4½ miles in 1895, to 5 miles in 1900 and 14 miles in 1908. Brick, beginning in 1894 has increased each year with reasonable uniformity to 22¾ miles in 1908. Sandstone, beginning in 1897, has increased similarly to 20 miles in 1908. Cresoted wood block, beginning in 1901 has increased in an increasing ratio to 31 miles in 1908.

The range of prices of paving in 1908, all work being done by the city by day's labor, is for brick paving from $1.33 to $2.53 a square yard; for cresoted block paving from $2.16 to $2.87 a square yard; for granite block from 55 cents in an alley to $2.61 a square yard; for sandstone block from $2.15 to $2.66 a square yard; for macadam from $1.13 to $1.24 a square yard.

ORGANIZATIONS AND INDIVIDUALS

Illinois and Indiana Water Supply Associations—National Association of Cement Users—Northwestern Cement Products Association—Chicago Cement Show—Concrete Associations—American Civic Association—Technical Meetings—Civil Service—Technical Schools—Personal Notes

Indiana Sanitary and Water Supply Association.

The annual meeting of the Indiana Sanitary and Water Supply Association will be held at the Claypool Hotel, Indianapolis, February 25, 1910. Among the papers to be presented the following have been announced:

"The Recent Richmond Valuation," by H. A. Dill.

"A Sewage Purification Plant," by C. Brossmann.

"Development of Centrifugal Pumps," by C. H. Hurd.

"Progress in Stream Pollution Elimination," by Dr. J. N. Hurty.

"Value of Accurate Water Works Records in the Light of Some Recent Valuations," by Dabney H. Maury.

"Water Softening," by Edward Bartow.

"The Wisconsin Utility Commission's Workings as They Refer to Water Companies," by B. H. Meyer.

"Sewage Plant at Ft. Benjamin Harrison," by Maj. Fauntleroy.

"Some Construction Features in Filtration Plants," by C. Arthur Brown.

Other well-known experts are on the program, the titles of whose papers are not yet announced.

The members of the new Illinois Sanitary and Water Supply Association and the Ohio and Kentucky members of the Central States Water Works Association have been invited to attend.

Conference of Illinois Water Supply Officials.

A conference of Illinois water officials with the state water survey will be held at Illinois University, February 16 and 17. Among the papers to be presented the following may be specially mentioned:

"Duty of Pumping Engines and Cost of Pumping water," by H. M. Ely, C. H. Cobb and C. R. Henderson.

"The Relation of the State Water Survey to Municipal Water Works," by Edward Bartow.

"The Sanitary Condition of the Southern End of Lake Michigan, Bordering on Lake County, Indiana," by H. E. Barnard.

"Streams Pollution and Purification," by Professor T. J. Burrill.

"Methods of Bacteriological Examination of Water," by Frank Bachmann.

"Methods of Chemical Examination of Water," by Lewis I. Birdsall.

"Correlations of Deep Well Records," by Professor J. A. Udden.

"Advantages of a Filtered Water Supply from a Business Standpoint," by Owen T. Smith.

"A Water Works Laboratory," by C. H. Cobb.

"Suggested Disposal of Drainage at Tolono, Illinois," by Professor Edward Bartow.

"Number and Size of Fire Streams for Fire Protection," by George C. Habermeyer.

"Methods of Measuring Water," by Professor A. N. Talbot.

National Association of Cement Users.

Following are the principal subjects of papers to be presented at the convention of the National Association of Cement Users, to be held in Chicago, February 21 to 24:

"The Use of Concrete for Farm Buildings from the Sanitary Standpoint," by S. Cunningham, Jr., New York, N. Y.

"Laying Concrete Under Water—Detroit River Tunnel," by Olaf Hoff, Consulting Engineer, New York.

"Comparative Value and Cost of the Groined Arch in Large Reservoirs," by T. H. Wiggin, Senior Designing Engineer, Board of Water Supply, New York.

"Concrete for Maritime Structures," by Chandler Davis, Department of Docks and Ferries, New York.

"Application of Concrete in Barge Canal Work," by R. S. Greenman, Office of State Engineer and Surveyor, Albany, N. Y.

"Comparative Cost and Efficiency of the Pneumatic Reinforced Concrete Dam."

"Additional Notes on Use and Cost of Concrete for Small Houses," by R. C. Knapp, Philadelphia, Pa.

"Advantages and costs of Reinforced Concrete Construction," by J. P. H. Perry, Contracting Engineer, Turner Construction Company, New York.

"Cost and Advantage of Concrete Drain Tile," by J. H. Libberton, Assistant Inspecting Engineer, Universal Portland Cement Company, Chicago, Ill.

"Installation and Operation of a Steam Curing Plant," by F. S. Phipps, Manager Central Stone Company, St. Joseph, Mo.

"The Preparation of Concrete from Selection of Materials to Final Deposition," by Harry F. Porter, Consulting Engineer, Bridgeport, Conn.

"Reinforced Concrete Columns," by Robert A. Cummings, Pittsburg, Pa.

"Reinforced Concrete Columns," by Peter Gillespie, Lecturer, University of Toronto.

"Use of Concrete in Protecting Wooden Piles Against Teredo," by Ralph Barker, Assistant State Engineer, San Francisco, Cal.

As usual, the reports of committees will be an important feature of the meeting. These committees will present for consideration proposed standard building regulations for the use of reinforced concrete, and specifications for concrete street pavements, Portland cement sidewalks, curb and gutter, plain concrete drain tile and architectural concrete blocks.

The sections under the charge of the various committees will hold special sessions for topical discussion of the subjects included in their respective fields.

Northwestern Cement Products Association.

Owing to the prolonged illness of President Roche and the business absence and consequent resignation of Secretary Piffner, it has been decided not to hold the convention of the Northwestern Cement Products Association at St. Paul in March. Instead, the convention will be held in Chicago, February 18, at the Great Northern Hotel, in connection with the great Chicago Cement Show. L. V. Thayer and E. S. Macgown, of Minneapolis, are the committee on the program for the convention.

The Chicago Cement Show.

In connection with the great Chicago Cement Show, to be held at the Coliseum, Chicago, February 18 to 26, inclusive, Percy H. Wilson, secretary of the Association of American Portland Cement Manufacturers, will present an elaborate series of illustrated instructive lectures on twenty-two subjects connected with the diversified uses of concrete. Three lectures a

day will be given, at 4:30, 8 and 9 p. m., in the west end of the Balcony Annex. The list of subjects is long, and includes every conceivable use of cement.

There are now seven association meetings to be held in connection with the show. In addition to the cement and concrete associations listed below are the American Society of Engineering Contractors, February 24-26; the National Builders' Supply Association, February 23-24; the Illinois Association of Municipal Contractors, February 24-26; the Illinois Lumber Dealers' Association, February 16-18; and the Illinois Masons' Supply Association, February 16-18.

The rates to the show will be 1½ fares. Certificate of purchase of ticket to Chicago at full fare must be obtained of the agent when purchasing ticket, and this certificate is the only document that will entitle to a return ticket at half fare.

Conventions of Concrete Associations.

The number of applications for space for exhibits at the third annual cement show to be held in Chicago from February 18 to 26, 1910, has been so large that the balcony and the second floor of the annex to the Coliseum will be utilized for exhibits. A feature of the cement show will be a continuous moving-picture exhibition in charge of the Association of American Portland Cement Manufacturers.

Besides the cement show the following conventions have been scheduled for 1910:

Lincoln, Neb., February 1-4, Nebraska Cement Users' Association.

Chicago, February 18-24, Concrete Machinery Manufacturers' Association.

Chicago, February 21-25, National Association of Cement Users.

Chicago, February 18-21, Northwestern Cement Products Association.

Cedar Rapids, Ia., March 9-11, Iowa Association of Cement Users.

American Civic Association Honored.

The action of President Taft in becoming a member of the American Civic Association is regarded as proof that the aims of the association are, in a sense, part of the Taft policies, as they relate to the improvement of community life and the preservation and development of national scenic beauty.

Technical Meetings.

The sixth annual convention of the Iowa Association of Cement Users will be held in Des Moines, Iowa, March 9, 10 and 11. Ira A. Williams, sec'y., Iowa State College, Ames, Ia.

The fifth annual convention of the Nebraska Cement Users' Association will be held at Lincoln, Neb., February 1, 2, 3 and 4. Address sec'y., care Lindell Hotel, Lincoln, Neb.

The annual convention of the National Brick Manufacturers' Association will be held at Pittsburg, Pa., February 7, 8, 9, 10, 11 and 12. T. A. Randall, sec'y., Indianapolis, Ind.

The annual meeting of the Connecticut Society of Civil Engineers will be held at New Haven, Conn., February 8. J. Frederick Jackson, sec'y., Box 1304, New Haven.

The annual meeting of the Ohio Engineering Society will be held at Columbus, Ohio., February 8, 9 and 10. C. J. Knisely, New Philadelphia, Ohio.

The annual meeting of the New England Association of Gas Engineers will be held at Boston, Mass., February 16. N. W. Gifford, sec'y., 26 Central Square, East Boston, Mass.

The annual convention of the Iowa Engineering Society will be held at Cedar Rapids, Iowa, February 16 and 17. A. H. Ford, sec'y., Iowa City.

The annual meeting of the American Society of Engineering Contractors will be held at Chicago, Ill., February 24, 25 and 26. D. J. Hauer, sec'y., 721 Park Row Bldg., New York City.

At a meeting of the board of directors of the American Institute of Electrical Engineers held December 16, 1909, a resolution was passed authorizing the meetings and papers committee to arrange for a meeting of the institute at some suitable point in the South Atlantic States during the month of March, 1910. The committee decided that the meeting shall be held at Charlotte, N. C., March 23, 24 and 25. As now arranged the program comprises the following papers: "Economics of Hydro-Electric Plants," W. S. Lee; "Electric Drive in Textile Mills," A. Milmow; "Calcium Cyanamid and Its Relation to Water Powers," Charles H. Baker; "Gas Engines in City Railway and Light Service," E. D. Latta, Jr.; "Protective Devices for High-Tension Transmission Lines," L. C. Nicholson. In addition to a number of attractive social features, a tour of inspection will be made to the Great Falls (S. C.) stations of the Southern Power Co. and a 100,000-volt sub-station. The official headquarters will be at the Selwyn Hotel. The Charlotte meeting is not to take the place of the institute's annual convention, which will be held as usual later in the year. The annual dinner will be held at the Hotel Astor in New York City, February 24. Mr. Elihu Thompson, past president, who has been awarded the first Edison medal, will be the guest of honor.

The twenty-fifth annual convention of the Illinois Society of Engineers and Surveyors, held at Cairo, Ill., January 26 to 28, included the following papers: "The Relation of Typhoid Fever Death Rate to the Water Supplies in Illinois," E. Bartow; "Municipal Engineering Work at Cairo," W. B. Thistlewood; "Chicago's Sidewalk Problem," N. E. Murray; "Materials and Workmanship in Street Paving," W. W. Marr; "Municipal Ownership of Public Utilities," J. W. Dappert; "Sewage Disposal Plants for Small Institutions," G. C. Habermeyer; "Recent Examples of Sew-

age Purification," W. S. Shields; "Reinforced Concrete Construction," A. J. Widmer; "Reinforced Concrete Aqueducts," H. E. Reeves; "Tests of Road Materials," A. B. Slippy; "The Drainage and Protection of Lands Subject to Overflow," C. W. Brown; "The Legal Liabilities of Levee and Drainage Districts," J. V. Waddell; "The Tallahatchie Drainage District," A. L. Dabney; "The Maintenance of Open Ditches," E. H. Cowan; "Water Supply and Drainage Investigations in Illinois," R. I. Randolph; "Observations of Engineering in Europe," F. O. Dufout; "Developments in Road Construction," A. N. Johnson; "The County Surveyor," P. T. Hicks; "The Cairo & Thebes Railway," G. F. Dewey; "Steel and Concrete Bridge Work on the Illinois Central Railway," R. E. Gaut; "Monazite and Its Uses," S. K. Atkinson; "Railway Engineering at the University of Illinois," Prof. S. S. Roberts; "Mining Engineering at the University of Illinois," Prof. H. H. Stoek; "Instruction in Hydraulic and Water Supply Engineering," Prof. G. C. Habermeyer; "Instruction in Road and Pavement Construction at the University of Illinois," R. B. Slippy; "The St. Louis and Cairo Division of the Deep Waterway," J. W. Woermann.

The fifty-seventh annual meeting of the American Society of Civil Engineers was held in the Society House in New York City, January 19. Suggestions for members of the nominating committee were received from 1,366 members, or about 31 per cent. of the corporate membership. Members of the nominating committee were elected as follows: District No. 1, James C. Meem, Brooklyn; Dist. 2, J. R. Worcester, Boston; Dist. 3, H. C. Allen, Syracuse; Dist. 4, J. E. Greiner, Baltimore, Md.; Dist. 5, Isham Randolph, Chicago; Dist. 6, Richard Montfort, Louisville, Ky.; Dist. 7, R. H. Thomson, Seattle, Wash. The special committees on steel columns and struts, and bituminous materials for road construction, whose reports were printed in the December "Proceedings were continued. The reports of the special committees on rail sections and on engineering education were accepted and the committees continued. The special committee on uniform tests of cement reported that during the last year it had arranged with the Ottawa Silica Company, of Ottawa, Ill., to prepare and deliver standard sand at 2 cents per pound, f. o. b. cars Ottawa. A minority report was presented by Alfred Noble, in which he reviewed the history of the committee's work, pointing out that the committee had been very active previous to 1903, holding frequent meetings and having the proposed methods carefully tested. At that time, he stated, a full report would have been premature. Since 1903, however, the meetings have been growing less and less frequent, and the changes in the report originally presented have been very few. He believes that the methods have now been sufficiently proved, and that the committee ought now to change the phraseology of the report as it now stands so as to eliminate the indefinite terms, and present this revision as a final report. After considerable discussion a resolution was carried accepting the present progress report of the committee, and continuing the committee, and directing it to bring in a final report at the next annual meeting Officers were elected as follows: President, John A. Bensel, New York City; vice-presidents, to serve two years, Col. John T. Fanning, of Minneapolis, and Hunter McDonald, of Nashville, Tenn.; treasurer, Joseph Knap, New York City.

The thirteenth annual convention of the Indiana Engineering Society was held in Indianapolis, Ind., January 13, 14 and 15. In his annual address President E. E. Watts referred to the industrial development in the state since the formation of the society in 1881, and of the increasing demand for technically trained men in engineering and contracting work. A number of technical papers were submitted at the various meetings, including one on "Concrete Sewer Construction," by F. W. Charles, and one on "Brick Paving of Highways in Delaware County," by J. O. Potter. In speaking on the subject of bituminous macadam road construction, Clarence A. Kenyon, of Indianapolis, made a comparison of the present practice in Indiana with that in some of the English cities. The importance of a good foundation and sand cushion in brick paving work was emphasized. Prof. W. K. Hatt, of Purdue University, commented upon tests of creosoted paving blocks. Sewage disposal and stream pollution were discussed, and a proposed design for a sewage disposal plant for Indianapolis was described by C. Brossman. The officers for the last year were re-elected as follows: President, Edwin E. Watts; vice-president, C. C. Brown; secretary and treasurer, Chas. Brossman. Directors—W. K. Hatt, C. A. Tripp, A. J. Hammond and W. C. Mabee.

The annual meeting of the New England Water-Works Association was held in Boston, January 12. Papers were submitted as follows: "Governmental Policy in Relation to Water Powers," Marshall O. Leighton; "The Maidstone Typhoid Epidemel." Dr. William P. Mason. Officers for the ensuing year were elected as follows: President, George A. King; vice-presidents, Allen Hazen, Ermon M. Peck, Michael F. Collins, Leonard Metcalf, Irving S. Wood and Frank A. McInnes; secretary, Willard Kent; treasurer, Lewis M. Bancroft; Editor, Richard K. Hale.

The Western Society of Engineers has elected the following officers for 1910: President, J. W. Alvord; vice-presidents, O. P. Chamberlain, A. Bement and W. K. Hatt, of Lafayette, Ind.; treasurer, A. Reichmann; trustees, L. E. Ritter, G. M. Brill, W. W. Curtiss. All are of Chicago except the one noted.

At the meeting of the Brooklyn Engi-

neers' Club, held January 13, Geo. A. Orrok presented a paper on "The Blast Furnace as a Power Producer." At the informal Thursday night talk of Jan. 27 J. C. Meem discussed "The Brooklyn Subways."

The Proceedings of the last convention of the National Municipal League have just been published in a volume entitled "Cincinnati Conference for Good City Government," which can be obtained from Clinton Rogers Woodruff, secretary, North American building, Philadelphia, Pa.

At the meeting of the New York Elec trical Society Prof. W. S. Franklin, of Lehigh University, lectured in "The Practical Applications of the Gyrostat." The lecture was illustrated, a working model of the Brennan mono-rail car was exhibited and afterwards Richard Scherl and Paul Froelich, the inventors of the Scherl gyroscope monorail car described its operation. Elmer A. Sperry opened the discussion with a talk about some of the gyrostatic work with which his name is associated.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Feb. 16, 17: Assistant and junior geologists in Geological Survey at $1,000 to $1,600 a year or per diem for time employed. Computer in Coast and Geodetic Survey at Manila, Philippine Islands, at $1,600 a year. Hydraulic engineer in Water Resources branch of Geological Survey at $1,200 to $2,400 a year.

March 9, 10: Topographic draftsmen in Coast and Geodetic Survey at $900 and $1,000 a year.

The Technical Schools.

Recent publications of the University of Illinois are Bulletin 31 on "Fuel Tests with House-Heating Boilers," by J. M. Snodgrass, and Bulletin 32 on "The Occluded Gases in Coal," by S. W. Parr and Perry Barker.

The journal of the Sydney University Engineering Society, Sydney, New South Wales, for 1908, vol. xiii, has been received and contains a valuable list of papers, mainly on mining engineering, but including one on modern sewage disposal and one on repulsion motors, the latter by H. R. Hillman, a graduate of Cornell University.

Printed report No. 10 of the Columbia University fire-testing station, Ira H. Woolson, director, describes fire tests of reinforced cinder concrete floor arches constructed by the Trussed Concrete Steel Co. of Detroit.

The fortieth annual catalog of Worcester Polytechnic Institute, Worcester, Mass., is received. About half the book is taken for brief but very comprehensive statements of the work and facilities of the institute and half for lists of graduates and students, with full information concerning their locations and occupations.

Columbia University announces courses of lectures in works management in the department of mechanical engineering during the next four months, by Charles B. Going in February, by Charles U. Carpenter and H. L. Gantt in March, by Mr. Gantt, Walter M. McFarland, Harrington Emerson and Richard T. Lingley in April and by Mr. Lingley and Edwin J. Prindle in May. The Hewitt lectures on power at Cooper Union will be given in February and March by Charles E. Lucke. Full information about the lectures will be given by F. P. Keppel, secretary of Columbia University,

Personal Notes.

Albert J. Johnston has been elected mayor of Sarnia, Ontario.

A. Givan has resigned as assistant engineer at Sacramento, Cal.

J. H. Dingle has been elected city engineer at Charleston, S. C.

William H. Lawton has been elected city engineer at Newport, R. I.

Arthur M. Compton has been elected assistant city engineer at Davenport, Ia.

Former Mayor John F. Fitzgerald was elected mayor at Boston, Mass., January 11.

Wallace Greenalch has been reappointed commissioner of public works at Albany, N. Y.

Robert Robinson, Sr., former mayor of El Paso, Ill., died at his home in that city recently.

Josiah A. Briggs has resigned as chief engineer of the Borough of The Bronx, New York City.

Wilfred F. Alexander, city clerk of Eastport, Me., died in that city January 14, aged 68 years.

Charles W. Appleby has been apopinted city engineer at New Albany, Ind., succeeding Samuel Mann.

John W. Hill, consulting engineer of Cincinnati, has been appointed a member of the Ohio State board of health.

John H. Emigh, consulting engineer and formerly city engineer of North Adams, Mass., died in that city January 6.

Prof. Willard C. Fisher, of the Wesleyan University faculty, was elected mayor of Middletown, Conn., January 17.

R. B. Smith has been appointed chief engineer of the board of public service at Sandusky, Ohio, succeeding C. M. King.

J. Leland Fitzgerald, the new city engineer at Schenectady, N. Y., has appointed W. E. Weller deputy city engineer.

John M. Hackett has been elected city engineer for a term of two years at Dunkirk, N. Y., to succeed James P. Morrissey.

Dr. S. G. Kerr, who was the first mayor of Asheville, N. C., died at his home in Knoxville, Tenn., January 16, aged 84 years.

I. N. Russell has been appointed superintendent of water-works at Salem, Ohio, succeeding George L. Wells, deceased.

John Cherry, Sr., a well-known paving contractor in Illinois, died at his home in Jacksonville, Ill., December 29, aged 73 years.

J. H. Weatherford has been re-elected city engineer of Memphis, under the new commission form of government, for a term of two years. This is a special compliment to Mr. Weatherford under the

conditions which have existed heretofore in Memphis and shows the confidence of the commission in his ability and uprightness.

E. N. Chisholm, of Columbia, S. C., has been appointed superintendent and manager of the water-works system at Knoxville, Tenn.

Frank J. Eppele, county engineer of Mercer, N. J., has been elected president of the County Engineers' Association of New Jersey.

Dr. Ernest J. Lederle has been appointed health commissioner to succeed Dr. Thomas A. Darlington, by Mayor Gaynor, of New York City.

Harry S. Holton, first assistant to the chief engineer of the board of public service, Columbus, Ohio, has been appointed director of public service.

Dr. D. W. Moore has been elected mayor of Jellico, Tenn. W. G. Smith, Phil Francis, F. C. Moore, George Russell, George Ellison and S. C. Baird were elected aldermen.

Benjamin Chatfield has been appointed superintendent of streets and sewers at Waterbury, Conn., and John R. Walker has been appointed superintendent of water-works.

John B. Batt has been appointed superintendent of water-works at North Tonawanda, N. Y., succeeding E. C. Heidenfeldt. A. P. Smith has been reappointed city engineer.

Prof. H. K. Barrows and Prof. C. B. Breed, of the Massachusetts Institute of Techology, have formed a partnership under the firm of Barrows & Breed, and will conduct a general consulting practice in civil engineering.

James V. Costigan has associated with himself E. H. Cahoon and C. F. Beck, in the Portage Engineering Co., with offices in the Doyle block, Akron, Ohio, to practice civil, mining, hydraulic and municipal engineering.

R. B. Smith has been appointed chief engineer to the State board of control at Sandusky, Ohio, and W. C. Scott has been reappointed chemist and superintendent of the water filtration plant.

The mayor of Cincinnati, Ohio, has made the following appointments: Chief engineer, department of public service, F. H. Shipley; superintendent of water-works, Robert Laidlaw; superintendent of distribution, J. A. Hiller; superintendent of filtration, J. W. Elims; engineer of street and sewer repair department, H. L. Conway. Mr. Shipley has been superintendent of the street and sewer repair department and Mr. Conway engineer in the track elevation and subway department.

Prof. Edward W. Bemis, superintendent of water-works at Cleveland, Ohio, has been appointed first deputy commissioner of the department of water supply, gas and electricity, New York City.

A. J. Hammond, M. Am. Soc. C. E., has resigned as city engineer at South Bend, Ind., and has established an office for general practice as civil and hydraulic engineer at 207 Summers building, South Bend.

W. A. McFarland, M. E., and Carroll Beale, C. E., Assoc. Mem. Am. Soc. C. E., have associated themselves to practice mechanical and civil engineering, with offices in the Washington Loan and Trust building, Washington, D. C.

W. C. Hollyday has resigned as superintendent of the water-works department of Columbus, Ohio, and W. W. Jackson, until now superintendent of machinery, has been temporarily appointed superintendent of the entire water-works department.

M. L. Worrell has been selected for the third time as superintendent of public works of Rome, Ga., in active charge of the water, sewer and street departments. He is the executive officer of the board of public works, whose members are level headed business men, looking for results and not for the payment of political debts.

City engineers have been appointed or elected as follows: Woonsocket, R. I., Frank H. Mills, re-elected; Dunkirk, N. Y., John M. Hackett, succeeding James P. Morrissey; Gloversville, N. Y., Morrell Vrooman, reappointed; Terre Haut, Ind., D. M. Roberts, succeeding E. B. Schmidt; Richmond, Ind., Fred R. Charles, reappointed; Natchez, Miss., O. M. Fowler, re-elected.

Swearingen and McCulloh are civil and consulting engineers at Great Falls, Mont. Mr. Swearingen has graduated from the city engineer's office, which position he held for fourteen years, and Mr. McCulloh from the positions of city engineer at Havre and later of assistant city engineer of Great Falls. They are demonstrating their ability by their work in designing sewer and water-works systems for Montana cities as well as in street, boulevard and park work.

MACHINERY AND TRADE

Aluminum Drafting Instruments.

The Ready Mfg. Co., Rochester, N. Y., are putting on the market a number of drawing instruments made of a special hard grade of aluminum at prices but slightly in advance of wood or amber, while their durability compares favorably with that of high priced steel instruments. They do not warp, rust or tarnish and should last a lifetime.

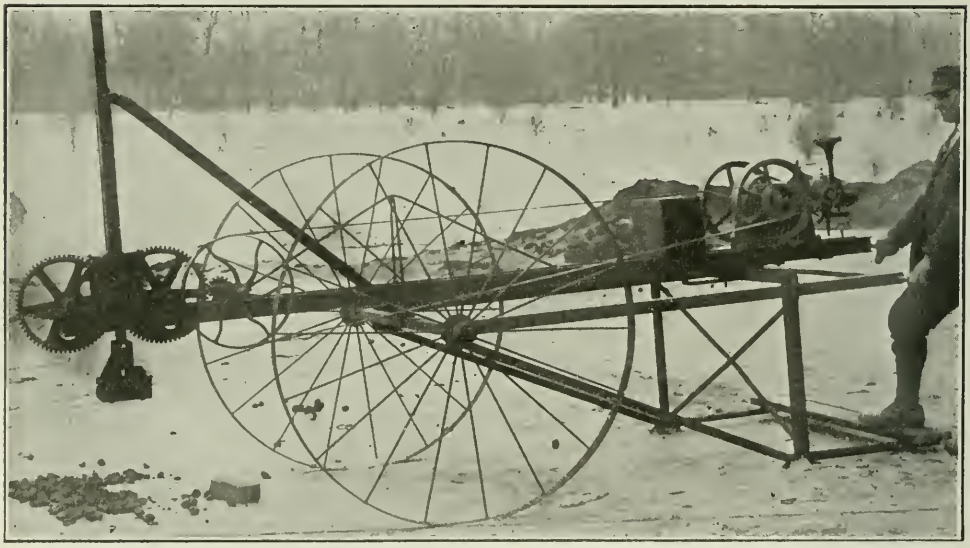
The instruments include railroad curves, protractors, circular and semi-circular, straight edges, T-squares and the "Ready" drafting instrument.

The latter has one arm about 6 inches long and another about 2½ inches long, with connecting straight and circular bars. It can be used with pin and pencil as a pair of compasses drawing circles differing in diameter by sixteenths of an inch from

¼ to 11 3-16 inches, as a protractor for drawing or determining angles with both long and short sides, it serves as a T-square and as a triangle, and is small enough to carry in the pocket and substantial enough not to be injured easily, and it costs only 50 cents. One side is graduated to 1-16 inches and ¾ scale and the other to 20ths or metric scale as preferred.

The Staley Power Tamping Machine.

The Staley power tamping machine is a machine designed to accomplish by power and in a thorough and workmanlike manner that laborious and often neglected operation in engineering works, the tamping of the back filling in trenches and other excavations where it is desired there shall be no future sinking of the back filling. This is especially desirable where pavements are to follow excavation operations. The machine has a large field in the many operations which require the opening of Improved streets, as with the power tamping the back filling and foundation may be tamped so firmly in place that the pavement may be relaid to grade without danger of a future depression in the replacement. It also has a large field in construction of cement walks, as the foundation may be firmly and cheaply tamped with the power tamper, also in many other operations which require tamping.



THE STALEY POWER TAMPING MACHINE.
For Earth Filling and Concrete.

The machine consists of two principal parts, a two-wheeled truck built of steel, properly braced and with the necessary handles and foot board conveniently located for the operator; a sweep made of two 3-inch steel channels mounted on a saddle near the center placed on a pivot on the truck axle, which gives the sweep a free horizontal movement. The rear end of truck has a sliding bearing on a cross member of the truck. On the front end of sweep is mounted the tamping mechanism. On the rear end is placed the air-cooled gasoline motor which is the power plant. The tamping mechanism is of the well known board drop hammer type; the board or plunger slides in steel guides attached to the steel channels. The plunger is lifted by two lifting rolls mounted on shafts running in bearings on the channels. The rolls are geared together by equal gears and are driven by a shaft and pinion gearing with one of the larger gears. The front lifting roll has a slight movement controlled by springs to enable it to grip the plunger. The length of stroke and releasing of the plunger are automatically controlled by cutting away a part of the circumference of the lifting rolls. The upper travel of the plunger is limited by reducing the thickness of the plunger near the lower end, which prevents the lifting rolls from gripping the plunger at this point. The plunger is retained in the upper and inoperatve position by means of two dogs or cams which, when it is desired to stop the plunger, are released and, engaging the side of same, prevent the fall of the plunger. These dogs or cams do not prevent the upward movement of plunger, so when they are released to control the plunger it is automatically run to the upper position. The tamping head may weigh up to 100 lbs.

The speed may be 60 to 75 strokes per minute and the drop up to 24 inches. The drop is by gravity.

In operation on trench work the machine would be placed straddle of trench. The operator is at rear end and may stand at one corner of truck where he can reach the sweep, which is moved horizontally for the transverse movement. The truck is pushed forward for the longitudinal movement. Thus any point within the range of machine may be struck. It will be seen that only the length of stroke is regulated; the position of tamping head is regulated only by the material being tamped and may be any place from the surface to six feet below. The tamping heads may be of any shape and can be changed in a few minutes. On solid footing one man with machine can do as much work as 6 to 10 men with hand tamper. As the machine is driven by power it does not get tired but stays right on the job.

The machine is put on the market by R. H. Staley, 305 Unity Bldg., Springfield, Ill.

Hydrated Lime Makes Waterproof Concrete.

The city of Kingston, Ont., built a gas holder with a circular concrete wall to hold the water seal. Poor concrete and poor workmanship caused the tank to leak so badly that it could not be used. In the spring of 1909 a contract was given to Lucius E. Allen, of Belleville, Ont., and Edward B. Merrill, of Toronto, two civil engineers, to make the tank water tight and they proceeded as follows:

The vertical wall was chipped back from three to six inches by means of pneumatic chisels and hand drills and the old concrete surface was systematically roughened and cleaned so as to secure the thorough adhesion of the new concrete. Special forms made on the principle of the stage or bridge used in theatres were made and the work of laying concrete was carried on continuously so far as possible, a complete ring being placed continuously.

The wall is now composed of a 3-inch thoroughly waterproofed concrete, proportioned 1-2-4 with about 18 per cent of high calcium hydrated lime added to the mass at the time of mixing. The materials used were Lehigh Portland cement, clean and well graded lake sand, crushed limestone and Crown hydrated lime. Special precautions were taken to insure thorough tamping of concrete, and the mixture was made sufficiently wet to flow freely.

Within three months from the time work commenced the tank was placed in commission and frequent tests have since been made by the city engineering department, which show a maximum leakage of under ten gallons of water in 24 hours, which may be accounted for by evaporation or absorption.

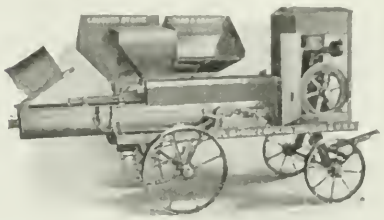
The holder, having now been in constant use for several months, is considered satisfactory from every standpoint, and the improvement is permanently completed.

The Crown hydrated lime is made from limestone 98 per cent pure calcium carbonate by the Marblehead Lime Co., 1105 Masonic Temple, Chicago, and 609 R. A. Long building, Kansas City, Mo., who use the vacuum process of hydration, the first successful process with high calcium lime for producing a dry hydrate.

The United States Standard Continuous Concrete Mixer.

The accompanying cut shows the United States Standard continuous concrete mixer made by the Ashland Street Range and Manufacturing Co., Ashland, O., the latest design of which was patented August 17, 1909.

The arrangement of hoppers and slides for automatic measurement of the aggregates and simultaneous discharge into the mixer can be seen in the cut. The box for measuring cement is seen at the end.



UNITED STATES STANDARD CONTINUOUS CONCRETE MIXER.

The feed from these hoppers is automatic and accurate, and it is only necessary to keep the hoppers and the cement box supplied with sufficient material.

The gasoline engine, mounted on the same truck, concentrates the power and its application as much as possible, and the box which encloses the engine protects it from the dust of the mixer.

Full information about the mixer and the excellent cement building block machine which they manufacture will be sent by the company on request.

The Secrets of Cement.

The Superior Portland Cement Company, with mills at Superior, Ohio, and offices in Cincinnati, tells all its secrets in a descriptive booklet now in press. In other words, the Superior people have nothing to hide, telling how their product is made, of what it is made and why it will last for ages. The reader takes a little journey to the company's mill, where he is entertained by Mr. J. B. John, who built and operates the plant. The trip is illustrated in an interesting way with fine half-tones and has an educational trend without being too technical or too involved in the science of the subject.

The idea is to tell the scientific story of Superior in a popular way. The booklet will be mailed free to those who ask for it.

The Book of American Municipalities.

The Book of American Municipalities for 1909 has just been issued by the Municipal Information Bureau of Chicago, which seems to have a close connection with the League of American Municipalities. It contains an authentic summary of civic progress and achievements. It contains full data from 83 of the larger cities of the United States, prepared according to a common standard form by a city official in each city, and is a valuable means of comparison of the results of municipal government in the cities listed. It costs $3.50 and can be obtained of the Municipal Information Bureau, 95 Dearborn street, Chicago, Ill.

The Cheesman Memorial.

The accompanying photograph shows the Cheesman Memorial, a handsome park structure in Denver, Col., designed by Mareau and Norton, architects. The structure is of white marble laid up in stainless white cement mortar and the surrounding walls, railings, balustrades, etc., are of concrete made with white cement. The Medusa white cement made by the Sandusky Portland Cement Co., Sandusky, O., was used.

CHESSMAN MEMORIAL, DENVER, COLO.

Prizes for Designs for Cement Houses.

The one branch of concrete construction which seems to have lagged behind the others in rapidity of development, is in residence construction. While considerable progress has been made in this field recently, it is nevertheless to be observed that architects and builders have rather neglected the possibilities of concrete in the building of homes, notwithstanding the fact that a concrete house offers several advantages of fire-proofness, permanency and low insurance. In this connection, it is interesting to note that the Pittsburg Architectural Club has taken steps to encourage and stimulate the interest of the architectural profession in cement house construction. The club is at present sponsor for a competition for designs for a cement house and garage which is attracting considerable interest among architects throughout the country.

The competition is open to practically all the architects in the country, and prizes, amounting to $500, are offered by the Universal Portland Cement Co., of Chicago and Pittsburg.

The designs will be exhibited at the fifth annual art exhibition at the Carnegie Institute Galleries at Pittsburg, and will probably be published later in booklet form by the cement company.

The jury will consist of:

Mr. Edward Stotz, president Pittsburg Chapter A. I. A.; Mr. Henry Hornbostel, dean department of architecture, Carnegie Technical Schools; Mr. Henry McGoodwin, assistant dean, Carnegie Technical Schools; Mr. J. Beatty Orth and Mr. D. E. Allison.

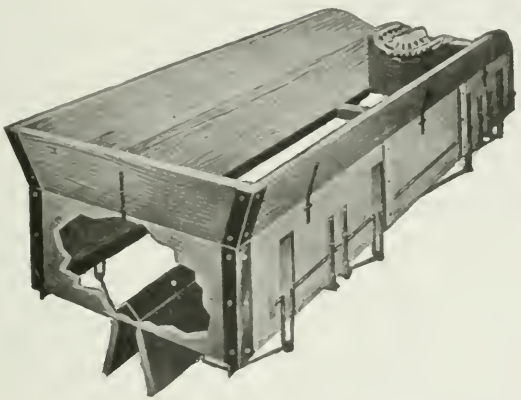
In making the reward the jury will consider the artistic quality of the designs, in regard to the materials used, the excellence of the plan, and the practicability of the constructive details, and will en-

deavor to obtain a design in which the imagination and ideas of the designer, in regard to good architecture, are practically and successfully worked out.

Drawings are to be delivered flat to the Pittsburg Architectural Club, Carnegie Institute, Pittsburg, Pa., not later than 12 noon, February 16. Detailed information can be obtained by addressing the club or the Universal Portland Cement Co.

The Chicago Quick Dumper.

The accompanying cut shows the Chicago quick dumping wagon bed, made by the Black Manufacturing Co., 215 to 219 West Ohio St., Chicago, Ill. It is a wagon bed which can be mounted on the ordinary wagon wheels and frame and is, as its name suggests, a quick dumper, for it opens promptly and completely, leaving the smallest possible obstruction to the fall of the material in the box and no opportunity for it to clog on the surfaces of the sides or bottom of the box. The mechanism for dropping the bottom leaves and returning them to place is of the simplest and can be seen in most part on the side of the bed in the cut. It is operated by the driver without leaving his seat. Those attending the Chicago Cement Show will find the company's representatives there and can also see the wagons at the ware rooms and in use in the city.



THE CHICAGO QUICK DUMPER.

The Fisher Power Tamping Block Machine.

The illustration herewith is the latest type of a power concrete block machine, and by its use the mortar is rammed by heavy hydraulic pounding displacing the air and bringing together the aggregates as one unit. Water is necessary to the crystallization of cement and it is necessary to use some power that will bring the aggregates together, permitting the cement to bond them. Many efforts have been made and many structures have proved unsatisfactory for the reason that this was not done.

The initial set begins soon after the mixing of the cement and water together, extending from two to four hours and in this time the silicates are formed and the strength and imperviousness of the stone depends largely on this early crystallization of these silicates. The quantity of water must be right. Too much is as bad as not enough. The correct amount of water is between a semi-wet mix and a pouring mix, called a plastic mix, which complies with all the specifications of architects and engineers.

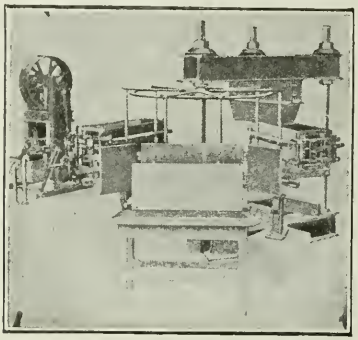
Now this hydraulic ramming of a plastic mixed concrete bringing the aggregates together into close union thus attaining the necessary density and obtaining crushing strength and a small percentage of absorption of water.

This system is not new as for years the inventor of this machine has had before the public a powerful ramming hydraulic press, and the quality of the product has never been questioned. But the expense of manufacturing this machinery and equipment has placed it beyond many who desired to use it and to the production of machinery that could be adopted and used by those desiring a true concrete, the inventor has given much thought. His system and machinery should be carefully investigated with a view to ascertain if it does produce a product with these qualities, placing the concrete block at the head of the building product of our country.

The machinery spoken of is driven by a 2-plunger hydraulic pump, and on the gauge is registered the power of the blows, which are sufficient to displace the air. Around the center strain rod is pinioned a table mounted on wheels, and on this table are fastened three mold boxes, that rotate from the filling table to the

press, to the delivery, and then again to the filling table, permitting the three mold boxes to be in operation all at the same time, one receiving the load, one being pressed, and one unloading, the operation requiring about one minute. Two men are sufficient to develop a large production of concrete blocks in a day's work.

The mold boxes are so arranged as to make a face either down or up, any style of one or two-piece solid, hollow or angular block. Any designed face pattern can be used as the delivery is made by bringing the front side over, turning the block on its side, resting on the pallet. When removed it frees itself from the pattern, making a convenient and easy operation outfit with a capacity suitable to its location and demand.



FISHER HYDRAULIC BLOCK MACHINE.

The inventor of this machinery has given great thought combined with his knowledge to the production of a dense concrete by hydraulic ramming, and to the perfecting of a machine to meet all the demands of the concrete block manufacturer. He would be pleased to give any information regarding this machinery to those desiring it. Ask for a catalogue of the Fisher Hydraulic Stone and Machinery Company, 26 Builders Exchange Bldg., Baltimore, Md.

Tests of Street Cleaning Machines in New York City.

The Commissioner of Street Cleaning in New York City, William H. Edwards, has had some tests of street cleaning machines made by District Superintendent A. F. Gunther, as a basis of information for the consideration of contracts for the next street cleaning season. The figures in the following table were compiled by E. D. Very, the engineer of the department, and are selected from the table showing the experiments in all the street cleaning districts because the districts shown in the accompanying table are the only ones in which the squeegee was tested.

The pavements are asphalt, granite and wood block, gone over as they were found, except that the squeegee was used on smooth pavements only.

It will be noted that the squeegee in every case cleaned the largest number of square yards per day and in every case but one used the smallest amount of water per 1,000 square yards.

This machine is made by the Kindling Machinery Co., of Milwaukee, Wis., who will give full information about it and the success it has attained.

Make of Machines.	No. of Days Test.	No. of Machines Tested.	No. of Square Yards per Machine per Day.	Gallons of Water Used per 1,000 Square Yards.
District No. 2.				
American	35	4	15,200	393
Connelly	23	2	16,800	480
Sanitary	47	4	13,406	995
Squeegee	20	2	21,247	404
District No. 5.				
Byers	47	3	9,827	666
Connelly	14	2	28,980	328
Sanitary	28	4	32,792	314
Squeegee	18	2	47,491	153
District No. 6.				
Connelly	23	2	26,689	463
Sanitary	31	2	27,347	385
Squeegee	15	2	68,948	125
District No. 7.				
Byers	47	2	15,137	675
Connelly	35	2	51,567	272
Sanitary	14	4	28,234	371
Squeegee	16	2	75,161	91
District No. 9.				
Connelly	25	2	38,572	273
Sanitary	13	2	25,522	324
Squeegee	18	2	46,142	121

A price of 13 1-3c per 1,000 gallons is charged by the city of New York to the street commissioner.

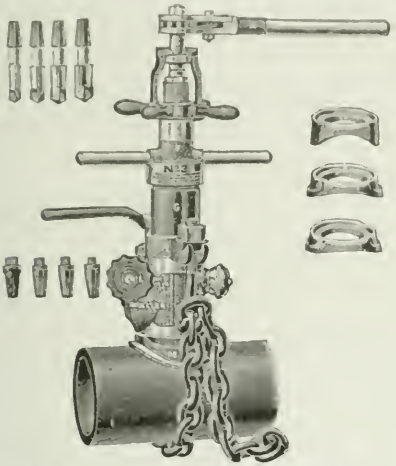
A Machine for Tapping Water Pipes Under Pressure.

The high state of development of the automobile is due the fact that men interested in its production did not rest when they had made a successful machine. They sought to better it, and kept on bettering it until they brought it to its present state.

This same policy has brought the Mueller Water Tapping Machine to its present high efficiency. The late H. Mueller was not satisfied with merely inventing and making a machine. He improved it and kept on improving it, each time adding to its effectiveness. The earlier machines were good, so good in fact that many of them are still in use. One man in Texas bought one of the early machines in 1884. He says it still does its work and is as good as ever, even though it lacks the improvements that have been made since.

The Mueller Water Tapping Machine of today embodies all the original points of the old one, but it has advantageous conveniences that make the work of tapping

easier. There is, however, nothing intricate about a Mueller Water Tapping Machine. Any one can use it by merely following directions. After the body has been securely fastened to the main, the boring bar holding the combined drill reamer and tap is inserted and the brass cap securely screwed down. The gate in the machine is opened, the feed yoke is thrown up over the collar and the machine is ready for operation. When the main has been tapped the tool is backed out, the gate closed and the tool removed. The corporation cock then takes the place of the tool in the boring bar, and is inserted in the body of the machine as was the tool. The advantage of this is obvious. The corporation cock must go straight to



MUELLER WATER PIPE TAPPING MACHINE.

the tap. It is just like re-inserting the tool or taking a wood screw out and putting it back in the same hole.

The Mueller Water Tapping Machine is easily handled, but it has plenty of weight to withstand the heavy strain that is necessarily entailed by tapping heavy mains. Literature giving full descriptions of these machines, the manner of operating, etc., together with complete illustrations, will be furnished on request by either the Decatur, Ill., or New York office of the H. Mueller Mfg. Company.

Slide Rule for Reinforced Concrete Slabs.

The slide rules are becoming so numerous and convenient that the engineer can safely forget his computing ability. The latest received by the writer is the slide rule for computing reinforced concrete slabs, designed and copyrighted by Prof. Arthur W. French, C. E., of Worcester Polytechnic Institute, Worcester, Mass. It has two slides and three fixed scales. The span in feet of the slab, the factors for simple and continuous spans, the load per square foot, the bending moment, the total slab depth and the area of cross section of the reinforcing steel are the scales on the rules, by the setting of which one quantity can be found if the others in its equation are given. On the scale of cross section of reinforcement are also given the sizes and shop numbers of expanded metal, Clinton cloth and A. S. & W. wire mesh corresponding thereto, and the sizes of square bars and round rods for spacings of 4, 5 and 6 inches. Thus, given the span, load and slab depth the metal required can be taken directly from the slide rule, and any other arrangement of known and required quantities can be made and the results obtained with the same ease.

The rule is of inexpensive construction and is graduated with all the accuracy required for its problems. Its price is $2. It is of pocket size, 4½ by 9 inches. The back carries the standard formulas and tables of sectional areas and weights of steel per foot width and per square foot of slab for various spacings and diameters of rods and bars.

Machinery for Pavements and Roads.

C. B. Smith, the chief engineer of the Atlas Dryer Co., Cleveland, O., was a recent caller at the office of MUNICIPAL ENGINEERING. He soon imbues a listener with his own enthusiasm over the dryer which his company is selling and for the design of which he is most largely responsible, and is quite as convincing about their one-car portable asphalt paving plant.

Mr. Smith is not satisfied with his past successes but is working hard on some much needed machinery for road building, with the chances almost unanimously in favor of his success.

Trade Publications.

Winnipeg, Man., is distributing calendars and maps demonstrating the strategic position of Winnipeg in the commerce of western Canada.

Tonindustrie Zeitung, the standard German publication in the clay and cement industries, has issued its usual annual calendar in three parts, one a pocket diary, one a handbook of information from the field and one a list of standard makers of and dealers in machinery and materials.

The offices of Advertising and Selling Magazine have been moved to the seventh floor of Masonic Hall Extension, 71 W. 23rd St., New York City.

Part six of "Building Details," published by Frank M. Snyder, architect, New York, has just been issued.

The Scofield bar for reinforcing concrete is described in a circular issued by the Scofield Engineering Co., Arcade Bldg., Philadelphia, Pa.

Transite Asbestos Wood is the subject

of a circular of the H. W. Johns-Manville Co., New York.

Bulletin No. 68 of the Universal Portland Cement Co. shows a miscellaneous lot of photographs of large and small work in which Universal Portland cement has been used.

Bitu-Mass Paving is described, with the machine for laying it, in a booklet of the American Paving and Manufacturing Co., Indianapolis, Ind.

The Weber-Duller Co., Houston, Tex., are engineers and contractors in civil hydraulic and sanitary engineering. They use the Thompson system of garbage crematories, which they are now putting before all the municipalities of the country, since the Thompson system is applicable to small as well as large cities. They use the Weber system for construction of concrete chimneys. David M. Duller, C. E., is the general manager of the company. He will send pamphlets descriptive of these two systems as well as of other classes of work in their field.

The Chicago Concrete Tool and Specialty Co., who will exhibit at the Chicago Cement Show, issue catalogue F of barrows, dump carts and an asphalt cutter.

The Edison Aggregate describes the Chelsea dock improvement in New York City, in which Edison cement was used. The piers are built to receive the largest ocean steamers and the land entrances and buildings are in keeping with the character of the dock work.

The latest circular of the Lehigh Portland Cement Co., in addition to a number of miscellaneous pictures, goes into detail regarding the Indiana State Tuberculosis Hospital, and the cover is a reproduction of a photograph of the finish of the surface of the concrete foundations.

Recent publications of the Jeffrey Mfg. Co., Columbus, O., are Booklet 34 on Jeffrey standard elevator buckets, Booklet 33 on Jeffrey wire cable conveyers, Catalog 69B of Jeffrey screens, and Bulletin No. 17 of Jeffrey mine locomotives.

"Placing Concrete in Freezing Weather" is the title of T. W. K. No. 4 issued by the Vulcanite Portland Cement Co., Philadelphia and New York.

Keuffel and Esser Co., New York and Hoboken, N. J., issue a pocket calendar and a solar ephemeris for 1910 as reminders of their business as dealers in instruments and supplies for engineers, draftsmen and surveyors.

The American Asphaltum and Rubber Co., Harvester Bldg., Chicago, Ill., has issued a handsome booklet showing the successful use of their Pioneer road asphalt for making roads and streets and the methods of construction. Their Pioneer reservoir waterproofing asphalt and Pioneer mineral rubber pipe coating are also very successful, and all three have passed the experimental stage.

Trade Notes.

ASPHALT.

Cleveland, O.—(Special.)—The Atlas Dryer Company is building one of its Atlas one-car portable asphalt paving plants, 1910 edition, for the Metropolitan Construction Company, of Kansas City, Mo. This is the third order received by this company from the Metropolitan Construction Company.

Reading, Pa.—E. B. Ulrich, city engineer, recommends, in his annual report, the purchase of an asphalt repair plant.

Pittsburg, Pa.—The board of reviewers has begun condemnation proceedings to acquire property for a site for a municipal asphalt plant.

Kansas City, Mo.—The new municipal asphalt repair plant has been completed at a cost of $30,000.

Wichita, Kas.—Rackliffe & Gibson, of St. Joseph, Mo., contemplate establishing a branch office here, making a specialty of Hassam paving.

BRICK.

Crawfordsville, Ind.—Fremont Alfrey, who has purchased 100 shares of stock of the Standard Brick Co., contemplates building new kilns and making other improvements.

CEMENT.

Birmingham, Ala.—The cement plant under course of construction at Ragland is about completed. Plans are being made by C. W. Hill & Co., engineers, for an addition to the plant, which the promoters fell convinced is necessary, owing to the growth of the demands for cement since they began the construction of the plant.

Easton, Pa.—The Alpha Portland Cement Co. held a special meeting Jan. 20, 1910, at Alpha, N. J., to consider a proposition to merge the Alpha Portland Cement Company with the Cement Mfg. Company. The latter company was recently formed to take over a portion of the property of the Alpha Portland Cement Company.

Omaha, Neb.—The Nebraska Portland Cement Company will make its headquarters in this city. The company's manufacturing plant will be established at Superior, Nuckolls county, a railway center for southern Nebraska and northern Kansas. The capacity of the plant will be 2,500 barrels daily. The testing laboratories of the company will be located at Kansas City.

Kansas City, Mo.—Negotiations are in progress for the merging of the cement plants at Iola, Kas., Dallas, Tex., South Pittsburg, Tenn., Des Moines, Ia., Independence, Kas., and Neodesha, Kas.

The Sandusky Portland Cement Co., of Sandusky, O., reports its pure white stainless Portland cement used on the following important jobs: Hospital, Ellis Island, N. Y.; Emigrants' Bank, New York City; National Museum, Washington, D. C.; Alfred Washington's residence, Glencoe, Ill.; Providence Hospital, Seattle, Wash.; Soulard Public Baths, St. Louis, Mo.; Mrs. Robt. Stafford's estate, Huntington, L. I.; H. R. H. Prince of Wales' racquette court, at Marlborough House; O. C. Barber's estate, Barberton, O.

Their Medusa waterproof compound was used in the following: Naval Y. M. C. A. basement and swimming pool, Norfolk, Va.; Rainier-Grand Hotel extension basement, Seattle, Wash.; Butler Bldg., San Francisco, Cal., basements 80 feet below sea level; Western Union Newspaper Bldg., Chicago, Ill.; swimming pool, University of Minnesota, Minneapolis, Minn.;

large building, 31st and 5th ave., New York, being waterproofed by the Hedden Construction Co.; Soulard Public Baths, St. Louis, Mo.; Gary Light, Heat & Water Co., power building, Gary, Ind.

CONCRETE BLOCKS.

Indianapolis, Ind.—The Indiana Concrete and Machinery Co. has been incorporated to conduct a general concrete and machinery business, by Carey L. Smith, Henry Bowser and James C. Hill.

Galveston, Tex.—The Gulf Concrete Cement Company has been incorporated by Capt. Alf Bryde and Daniel Wallis, of this city, who will soon establish industries in Galveston, Harris and other counties in this state for the manufacture of concrete piling. The company will use methods and patents controlled by the Portland, Ore., Cement Pile and Equipment Co.

Windom, Minn.—The removal of the cement tile plant of Mr. Doolittle, of Webster City, Ia., to this city is under consideration, providing $5,000 worth of stock in the company, to be organized, is taken by the citizens.

Columbus Junction, Ia.—E. A. Shaver, of Wellman, Ia., will establish, during next summer, a cement brick and tile plant here.

PURCHASE OF MATERIALS.

Lansford, Pa.—(Special). Edward J. Jones advises us that he is in the market for 100,000 paving brick.

Jasper, Ala.—(Special.)—J. R. Smith, C. E., desires prices on materials for paving sidewalks and streets.

PURCHASE OF MACHINERY.

Lansford, Pa.—(Special). Edward J. Jones advises us that he is in the market for three steam rollers and two cement mixers.

Doon, Ia.—(Special). John Swimmy advises us that he is in the market for a concrete mixer.

Jasper, Ala.—(Special.)—J. R. Smith, C. E., advises us that he desires to purchase machinery and tools for constructing sewers.

LIGHT, HEAT AND POWER.

New York City.—The Hartwick Power Co. has been incorporated to manufacture electricity for light, heat and power. The incorporators are Lawrence J. Mayer, 216 W. 100th st.; and Carleton Bune, 244 W. 57th st., New York City; Frank L. Hilton, 11 Bentley ave., Jersey City, N. J.

Houston, Tex.—The Houston Gas Bill Reducing Company has been incorporated by J. C. Robinson, H. T. Fisher and C. I. Peckham.

MISCELLANEOUS.

Fulton, N. Y.—The Fred Pierce Sand Co. has been incorporated to sell sand, gravel, stone and building materials, by George F. Stackhouse, 16 New st., East Orange, N. J.; Albert M. LeMessuier, 215 Elk st., Syracuse, N. Y.; Claude E. Gurle, 512 Broadway, Fulton, and others.

Findlay, O.—The Buckeye Traction Ditcher Co. contemplates building an additional factory.

Dallas, Tex.—The General Fire Extinguisher Co. has been incorporated by Richard W. Finley, Sidney S. Smith and James W. Conaway.

Allentown, Pa.—The Catasaqua Construction Co. has been organized to construct bridges, sidewalks and roads, by Alvin J. Hoffman, William A. Follweiler, Samuel A. Wenrich and Calvin D. Peters.

Patents on Concrete Posts and Poles.

879,076. Post Mold. Jonas H. Wiest, Indianapolis, Ind.

881,747. Artificial Stone Fence. Louis Townsend, Evansville, Ind.

882,131. Concrete Fence Post. Franklin P. Van Hook, Normal, Ill.

882,439. Fence Post Mold. Jordan D. Williams, Indianapolis, Ind.

883,005. Post. John H. Doddridge, Vincennes, Ind.

883,022. Cement Post. Chas. Hornshaw, Port Huron, Mich.

883,491. Fence Post (concrete). Louis H. Scott, Princeton, Ill.

883,569. Mold for Fence Posts. Harvey H. Rodgers, Good Hope, O.

883,913. Fence Post. Geo. W. Pyle, Geneva, Ind.

884,171. Pole (reinforced concrete). Diedrich W. Krellwitz, St. Catharine's, Ont., Can.

884,502. Fence Post Mold. Chas. F. Kyser, Saranac, Mich.

887,206. Mold for Forming Artificial Stone Posts. John E. Logan, Kansas City, Mo.

887,498. Concrete Fence Post. Henry A. McElhinney, Detroit, Mich.

887,796. Means for Protecting Poles, Piles and Posts from Decay. Edward B. Harang, Chicago, Ill.

888,719. Fence Post. Chas. A. Mendenhall, Farmland, Ind.

889,091. Mold for Posts. Harvey Ballinger, Marion, Ind.

891,246. Post (concrete). Hiram H. Grissom, Balbec, Ind.

892,592. Post and Tile Mold. Frank and Chas. J. Helm, Traverse City, Mich.

892,826. Reinforced Concrete Post. Ira L. Graham, Payne, O.

892,880. Pole (wood, steel and concrete). Robert S. Orr, Pittsburg, Pa.

893,156. Fence Post. Harry M. Fewins, Woodbine, Ia.

893,734. Cement Post Fastener. Chas. B. Ingraham and Aurel L. Moser, Laurel, Ia.

894,794. Fence Post. Jas. H. Hufford, Muncie, Ind.

895,691. Fence Post Molding Apparatus. Louis H. Scott, Princeton, Ill.

895,981. Fencing Fastener for Fence Posts. Jeremiah J. Dickson, Indianapolis, Ind.

897,632. Concrete Fence Post. Chas. Kubach, Abilene, Kans.

897,773. Fence Post. Arnold Pagel, Racine, Wis.

898,671. Apparatus for Molding Bases on Fence Posts. Marshall C. Munn, Sycamore, Ill.

899,416. Multiple Mold for Fence Posts. Chas. Kubach, Abilene, Kans.

901,449. Metal Reinforced Concrete Post. Lemuel J. Husted, Denver, Col.

904,098. Mold for Fence Posts. Jesse B. Storms, Albion, N. Y.

904,487. Fence and Hitching Post (concrete). Wm. H. Kessler, Merwin, Mo.

905,794. Method of Constructing Fence Posts. Zachary T. Crego, Columbus, O.

907,494. Mold (for concrete posts). Frank B. Harding and John J. Brubeck, Rockville, Ind.

909,875. Mold for Making Cement Fence Posts. Joseph M. Denning, Cedar Rapids, Ia.

910,620, 910,621. Post and Brick Molds. Cyrus S. Wert, Kendallville, Ind.

910,843. Reinforced Concrete Post. Jas. Needs, Fakenham, Eng.

911,584. Concrete Fence Post. Harley L. Ford, Ottumwa, Ia.

912,249. Machine for Molding Bases Upon Fence Posts. Chas. S. Long, Aurora, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Springfield, Mass.—Arthur A. Adams, superintendent of streets, in his annual report asks for a larger appropriation for streets during the next year.

CONTEMPLATED WORK.

Norfolk, Neb.—Norfolk ave. will be paved.

Lestershire, N. Y.—Paving is contemplated for Main st.

Neenah, Wis.—Concrete paving is contemplated in Sherry st.

Alton, Ill.—About 2 miles of brick paving is contemplated.

Dayton, O.—Paving is contemplated for Germantown st.

Dundee, Neb.—Asphalt and other paving is contemplated next spring.

Fond du Lac, Wis.—Cement paving is contemplated in Armory and Sixth sts.

Kent, Wash.—Brick paving is contemplated for Front st. and Meeker ave.

Denton, Tex.—The macadamizing of E. Hickory st. is again being urged.

Marion, Ia.—Resolutions have been passed for paving 13 blocks of streets.

Webster City, Ia.—Council will soon take up the question of paving extensions.

San Diego, Cal.—Plans and specifications have been prepared for repaving H st.

Ames, Ia.—Creosoted wood block paving is contemplated for Onondaga st.

Pasadena, Cal.—Brick paving is contemplated for S. Pasadena ave.

Eagle Grove, Ia.—The city council contemplates paving 6 blocks of Broadway.

Reading, Pa.—Paving is proposed for Spruce and Chestnut sts. Mayor Rick.

Binghamton, N. Y.—New macadam paving is contemplated for Front st. this year.

Harrisburg, Pa.—Mayor Meals is in favor of paving the street intersections.

Escanaba, Mich.—Additional asphalt paving is contemplated in N. Mary and S. Mary st.

Vinton, Ia.—Council has appointed a committee to investigate the paving question.

Tonowanda, N. Y.—A petition is being circulated asking that Morgan st. be paved.

Harvard, Ill.—The question of paving several streets is being considered by the council.

Willimantic, Conn.—The mayor recommends, in his annual message, the paving of Main st.

Scranton, Pa.—The residents in North Park are in favor of paving Electric st. with asphalt.

Oceanside, Cal.—Plans are being prepared for constructing a macadam boulevard in Hill st.

Eveleth, Minn.—Plans will be prepared by cy. engr. Austin for paving 6 blocks of Grant ave.

Harlan, Ia.—Paving is contemplated for the public square and the streets leading to the depot.

Duluth, Minn.—Bids will probably be asked in March for paving E. Superior st. and Lake and 1st aves. R. Murchison, clk. B. P. W.

Beloit, Wis.—About 1 mile of brick paving is proposed for Prairie ave. Robt. Caldwell, cy. engr.

Greenview, Ill.—The construction of more concrete sidewalks is contemplated next spring and summer.

New Orleans, La.—Bitulithic paving is contemplated for Prytania st. and granite blocks for Hurst st.

Menasha, Wis.—Plans have been prepared for constructing concrete paving in Racine and other streets.

Platteville, Wis.—Plans will be prepared for paving Main st. with brick. P. D. Hendershot, Jr., cy. clk.

Elizabethtown, N. Y.—Brick paving is contemplated for the main street in the village of Lake George.

Irvington, N. J.—An ordinance has been passed providing for flagging Laurel ave. W. L. Glorieux, mayor.

Pekin, Ill.—The property owners in Park ave. have decided in favor of brick paving with cement filler.

Greensville, Tenn.—Voted to issue bonds for constructing 3½ mis. of streets in this city. Pike comrs.

York, Pa.—The property owners in Duke st., between Philadelphia and Market sts., are in favor of repaving.

Des Moines, Ia.—Plans and specifications are being prepared and bids will be asked soon for paving 21 streets.

South Omaha, Neb.—Specifications have been submitted for paving 39th ave. and 39th st. with Purington brick.

Eldora, Ia.—Council is considering the question of constructing about 1 mi. of creosoted wood block or brick paving.

Hamilton, Ont.—Voted to issue $200,000 bonds for asphalt paving on concrete base. J. A. Macallum, cy. engr.

Lebanon, Pa.—An ordinance has been passed providing for an appropriation of $1,000 for improving and macadamizing 7th st.

Elkhart, Ind.—A resolution has been adopted for improving S 2nd st. and Redding ave. Objections will be heard Feb. 7.

Lincoln, Ill.—A petition is being circulated asking that Kickapoo st. be paved with mineral rubber asphalt instead of brick.

Tacoma, Wash.—Council voted to construct cement sidewalks in S. 10th and other streets, and pave 6th ave. with asphalt.

Tucson, Ariz.—The mayor, in his annual message, recommends the paving of the streets in the business section of the city.

Pasadena, Cal.—A contract will be let in about 3 weeks for paving Broadway st. with vitrified brick. Heman Dyer, cy. clk.

Peoria, Ill.—Brick paving on concrete base is contemplated for S. Garfield ave. and W. Armstrong st. Objections will be heard Feb. 7.

Ames, Ia.—Council will take final action Feb. 21 on the proposed paving of Onondaga and other streets with creosoted wood blocks.

Los Angeles, Cal.—A contract will be let soon for constructing about 3 mis. of

the Los Felix road, from Hollywood to San Fernando.

Raleigh, N. C.—An ordinance has been passed providing for brick paving in Fayetteville and Martin sts. and the streets about Capitol Square.

Appleton, Wis.—Plans will be submitted to the city council Feb. 2 for about $50,000 worth of street paving. C. H. Vinal, cy. engr.

Spokane, Wash.—Plans have been completed for grading, curbing and constructing sidewalks in Rich ave. and for paving Howard st. with brick.

Oconomowoc, Wis.—Plans have been prepared for paving N. Main and Milwaukee sts. with cement concrete, vitrified brick and creosoted wood blocks.

Newton, Ia.—The city council has directed the city solicitor to prepare resolutions for constructing about 45 blocks of new paving next summer.

Altoona, Pa.—In his annual message the mayor recommends $100,000 for continuing the street paving, and $75,000 for resurfacing wornout asphalt paving.

Chicago, Ill.—The bd. of local impvts. has deferred final action until April 20 on the formal petition for widening Michigan ave. as a surface boulevard.

Rock Island, Ill.—Ordinance are proposed providing for 36 blocks of new brick and asphalt paving, at a cost of $172,121.90. G. W. McCaskrin, mayor.

Rock Island, Ill.—The property owners in 11th ave. from 9th to 22nd, are urging the revival of the ordinance for paving with asphalt.

Galveston, Tex.—The comr. of sts. has been directed to ask for bids for paving 25th st. from Avenue A to Winnie st. with vitrified brick. Mayor Fisher.

Atlantic City, N. J.—The city engineer has been directed to prepare plans and specifications for paving Hammock ave. and other streets with bitulithic or other material.

Crawfordsville, Ind.—A resolution has been passed providing for the construction of cement sidewalks in Water st. from Market to College. Fred B. Robinson, cy. clk.

South Orange, N. J.—John F. McDonough, chmn. st. com., has recommended that the streets of this village be treated with oil next summer instead of being sprinkled with water.

Sheboygan, Wis.—The bd. of pub. wks. recommends vitrified brick paving and stone curbing in S. Water and other streets, and macadam paving in Maryland ave. and other streets.

Bloomington, Ill.—Brick paving, stone curbing and cement and asphalt filler are contemplated for Jefferson, Evans, Main, Grove, Gridley, Washington and Madison sts. Cy. engr. Folsom.

Milwaukee, Wis.—The property owners in Holton st., from Reservoir to North ave., voted to circulate three petitions, providing for bitulithic, creosoted blocks and Kettle river sandstone.

Des Moines, Ia.—The city council will take final action Feb. 7 on creosoted wood block paving in 8th st., cement curbing in Clark and 42nd sts.; asphalt paving in 42nd st.; cement curbing in 35th st.

Wichita, Kas.—The property owners in S. Lawrence ave. advocate bitulithic paving for a distance of ¾ mi. Resolutions have been passed for paving Roosevelt ave. with brick blocks; 1st st. with creosoted wood blocks; Circle Drive, brick blocks.

Wauseon, Wis.—(Special). O. A. Wennberg, asst. cy. engr., says that city council, at its regular meeting, held Jan. 4, directed B. C. Gowen, cy. engr., to prepare plans and specifications and submit them at a special meeting of the council to be held Jan. 19, for the construction of about 200,000 sq. yds. of brick or creosoted wood block pavement. The contract will be let in March.

CONTRACTS TO BE LET.

Normal, Ill.—Bids are asked until Feb. 5 for paving Broadway. Bd. local impvts.

Oconomowoc, Wis.—Bids are asked until Feb. 11 for improving Collins st. B. P. W.

Ocean Park, Cal.—Bids are asked until April 1 for a steam road roller. Cy. coun.

Norfolk, Va.—Bids are asked until Feb. 8 for repaving Granby and Chapel sts. with smooth material.

St. Paul, Minn.—Bids are asked until Feb. 21 for the Birch Lake ave. road. Ed. G. Krahmer, co. audt.

Monticello, Ind.—Bids are asked until Feb. 8 for constructing stone roads. A. G. Fisher, co. audt.

Cincinnati, O.—Bids are asked until Feb. 11 for improving certain roads. Fred Dreihs, clk. co. comrs.

Kentland, Ind.—Bids are asked until Feb. 7 for constructing a macadam road. Elmer R. Bringham, co. audt.

Kearney, Neb.—Bids are asked until Feb. 16 for improving 5½ mls. of dirt road. E. A. Miller, co. audt.

Jefferson Barricks, Mo.—Bids are asked until Feb. 5 for constructing roads, walks, etc., here. Capt. Stanley H. Ford, Q. M.

Gibson, N. C.—Bids are asked until Feb. 7 for constructing 2.7 mls. of sand and clay roads. J. C. Mason, chmn. co. road com.

Gordon, Ala.—Bids are asked until Mar. 15 for constructing 51 mls. of graded road in Houston county. W. J. Parish, co. comr.

Moline, Ill.—Bids are asked until Mar. 1 for constructing driveways, etc., in part of Riverside cemetery detached for park purposes.

Palatka, Fla.—Bids are asked until Feb. 5 for constructing a hard-surfaced road. S. Woren, clk. bd. trustees for co. bds., 722 Water st.

Pipestone, Minn.—Bids are asked until Feb. 25 for removing obstructions at the falls and improving the highway to the cemetery. Wm. S. Campbell, supt.

Raleigh, N. C.—Bids are asked until Feb. 2 for constructing 25,000 sq. yds. of brick paving in Fayetteville and other streets. R. B. Seawall, cy. engr.

CONTRACTS AWARDED.

Kendallville, Ind.—The contract for paving was awarded to Fred Hoffman, of Rochester, for $40,625.

Fulton, N. Y.—The contract for paving N. 1st st. was awarded to J. A. Fitch, of this city, for $9,055.

Portland, Ore.—The contract for 28,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co.

Ironton, O.—The Ironton Construction Co. was awarded the contract for paving 4th st. with brick, for $12,859.

East St. Louis, Ill.—The Myers Construction Co. was awarded the contract for improving 25th st. for $16,301.

Millvale, Pa.—John Battenfield & Son, of this city, was awarded the contract for grading, curbing and paving Sample st.

Ligonier, Ind.—The contract for paving with Nelsonville block was awarded to Tripett & Son, of Peru, for $13,320.

Winnetka, Ill.—The contract for street improvement here was awarded to James Cape & Sons, of Racine, Wis., for about $20,000.

Wharton, Tex.—The contract for draining and curbing around the public square was awarded to E. E. Carson, for $3,400.

Salt Lake City, Utah—Contracts for

paving 9th East st. and 1st ave. have been awarded to P. J. Moran, for $151,-474.47.

Winston, N. C.—The Atlantic Bitulithic Co. secured the contract for constructing 6,700 sq. yds. of bitulithic paving.

Davenport, Ia.—The McCarthy Improvement Co. was awarded the contract for all the brick paving ordered in certain streets.

Mobile, Ala.—The Jett Brothers Contracting Co. was awarded the contract, Jan. 6, for paving Water st. with cement, for $5,438.98.

San Diego, Cal.—The contract for paving Union and Front sts. was awarded to the Fairchild-Gilmore-Wilton Co., at 16.3 cts. a sq. ft.

South Bend, Ind.—The contract for paving Prairie st. with brick, comprising 30,-922 sq. yds., was awarded to H. M. Barnes, for $56,000.

Fort Worth, Tex.—(Special). The Texas Bitulithic Co. was awarded the contract for paving Missouri and College aves. with bitulithic.

Guthrie, Okla.—The contract for paving Washington st. with asphalt was awarded to the J. F. Hill Paving Construction Co., at $1.94½ a sq. yd.

Houston, Tex.—A. T. Lucas was awarded the contract for constructing brick paving in Washington, San Jacinto, Travis and Main sts., for $32,152.

Puyallup, Wash.—(Special). The contract for constructing 19,000 sq. yds. of bitullthic paving was awarded to the Warren Construction Co.

Ford, Mich.—The contract for constructing Metropolitan brick paving in Biddle ave. was awarded to J. E. Conley & Co., of Dayton, O., for $65,000.

Sumter, S. C.—The contract for constructing about 4,000 sq. yds. of cement sidewalks was awarded to J. D. McGee, of Greenville, at 89 cts. a sq. yd.

Little Rock, Ark.—The contract for paving W. 8th st. with macadam, with asphalt binder, was awarded, Jan. 5, to M. D. L. Cook, of this city, for $13,068.

El Paso, Tex.—(Special). The contract for constructing 9,170 sq. yds. of bitulithic paving in S. Orange st. was awarded to the Texas Bitulithic Co.

Logansport, Ind.—The contract for constructing a new sidewalk on the east side of Cicott st. bridge across the Wabash river was awarded to S. S. McKinney.

Lenoir, N. C.—The contract for grading and macadamizing about 3 mis. of road near here has been awarded to Hart & McAbee, of Hickory, N. C., for about $25,000.

Schenectady, N. Y.—The contract for paving Altamont ave. was awarded to the Union Paving Co., 525 State st., at $2.20 a sq. yd. for asphalt, and $2.42 for brick.

Newbern, N. C.—The contract for constructing about 45,000 sq. yds. of brick paving was awarded to Rowe & Page, of Charleston, S. C., at $1.41 a sq. yd., for about $60,000.

Columbus, O.—Paving contracts have been awarded as follows: Glenwood ave., Trimble block, Wm. H. Luchtenburg & Co., $32,472; Center ave., Geigler & Carns, $9,176; 9th st., Budd & Bortling, $5,400; Scioto st., Harry J. Shaw, $9,896.

Indianapolis, Ind.—Contracts for paving have been awarded as follows: Layman ave., brick, George McCray, $2.79 per ft.; sidewalks and curbs in 28th st., Lawson & Kincaid, $1.29 a sq. ft.

Ottumwa, Ia.—Contracts were awarded, Jan. 3, including 10,000 lin. ft. of curbing, for paving as follows: Brick paving, 16,-000 sq. yds., J. C. Black, of this city; creosoted wood block paving, A. C. Morrison, of Minneapolis, Minn.

Mexico City, Mex.—The Mexican government has approved a contract between the government and the Compania Asphalto y Construcciones, one of the Doheny interests, for the construction of 30 new asphalt streets in this city. The contract price is $3.15 gold per square meter.

Long Beach, Cal.—Street paving contracts have been awarded as follows: C. W. Brashear, Hellman Bldg., Los Angeles—Appleton st., $20,276; Railway st., W., $13,019; American ave., $32,154; Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., Los Angeles, Railway st., E., $17,721. C. H. White—Linden ave., $40,-086; Kennebec st., $1,152.

New York City—Bids were submitted Jan. 18 for repairing and maintaining sheet asphalt pavements in Manhattan, as follows: Barber Asphalt Paving Co., 30 Church st., New York, $118,700; Uvalde Asphalt Co., 1 Broadway, New York, $128,975; Sicilian Asphalt Co., $184,100.

SEWERS.

CONTEMPLATED WORK.

Wolsey, S. D.—A sewerage system is contemplated.

Prescott, Ont.—Voted to issue bonds for the extension of sewers.

Huntsville, Ala.—The city council is negotiating for a new sewerage system.

Monrovia, Cal.—Will vote on the construction of a sewerage system.

Chatham, N. J.—Voted to issue bonds for constructing a sewage disposal plant.

Corydon, Ia.—The construction of a sewerage system is contemplated.

Carterville, Ga.—Surveys will be made at once for constructing a sewerage system.

Edmonds, Wash.—This city has decided to construct a strunk sewer.

Boise, Idaho—Will vote, Mar. 1, on the issue of bonds for constructing a storm sewer.

Canton, Ill.—Plans are being prepared for rebuilding and enlarging the sewerage system.

Mandan, Ia.—Plans and specifications are being prepared for constructing a sewerage system.

Morristown, Tenn.—Voted to issue bonds for constructing a sewerage system. D. C. Morris, cy. recdr.

Duluth, Minn.—Plans are being prepared for a sewerage system at Rice's Point and Minnesota Point.

Berkeley, Cal.—Plans are being prepared for improving the sewerage system. J. J. Jessup, cy. engr.

Geneva, N. Y.—Commissioners Bowen and Henry have been appointed a committee to consider the matter of sewage disposal.

Galveston, Tex—.The construction of a large concrete drain in the East End is contemplated. Mayor Fisher.

Westfield, N. Y.—Plans for a sewerage system, including a sewage disposal plant, have been submitted.

Davenport, Ia.—City Engineer Murray has submitted plans and specifications for 4,400 ft. of sewer along the levee front.

Missouri Valley, Ia.—Surveys for a sewearge system have been prepared by the Iowa Engineering Co., of Clinton, Ia.

Lake Charles, La.—Surveys have been completed and preliminary plans for a sewerage system will be ready about Feb. 20.

Jefferson, O.—An ordinance has been passed authorizing the construction of a sewage disposal plant and sewerage system.

Houston, Tex.—A hearing will be held Feb. 7 on the petition for the establishment of Harris county drainage district No. 4.

Omaha, Neb.—City Engineer Craig advocates the construction of storm water sewers in the down-town business district.

Wheatland, Wyo.—The question of installing a sewerage, water works and electric light system is under consideration.

Kingston, N. Y.—Voted to construct about 9 mls. of sewers and a sewage disposal plant. Geo. N. Bell, engr., Kingston.

Roseville, Cal.—The construction of a sewerage system and improved streets is under consideration. F. C. Hill, cy. clk.

Savannah, Ga.—J. W. Howard, cy. engr., has been directed to prepare plans for the extension of the house drainage system.

North Adams, Mass.—Surveys have been made for constructing sewers in the western end of the city. R. L. Gardner, cy. engr.

Monroe, Wash.—The city council has ordered the construction of a trunk sewer, and bids will soon be asked for its construction.

Binghamton, N. Y.—Plans are being prepared for the extension of the Conklin ave. trunk line sewer. John A. Giles, cy. engr.

Attleboro, Mass.—Will vote in February on the advisability of constructing a sewerage system. Dr. C. S. Holden, chmn. sewer com.

Tuscaloosa, Ala.—Plans are being prepared and the contract will be let soon for constructing sanitary sewers. W. H. Nicol, cy. engr.

Columbus, O.—A resolution has been adopted for the construction of a sewer in State st., and bids will soon be asked for its construction.

Kansas City, Mo.—Plans have been completed for constructing the Brush Creek sewers, and bids will be asked for soon. J. L. Darnell, cy. engr.

Colton, Cal.—Plans have been completed and the question of constructing a sewer will be voted on in February. W. L. Martin, cy. engr.

Memphis, Tenn.—The residents in the extreme southern and eastern parts of this city are to have a sewerage system as soon as the plans are completed.

Pekin, Ill.—The city council recommends that a contract be made with J. W. Alvord, of Chicago, to prepare plans for constructing a sewerage system.

Providence, R. I.—Council has passed a resolution to petition the legislature for permission to issue an additional $500,000 for sewer construction.

Marcus Hook, Pa.—An ordinance has been passed providing for the installation of sewerage system and sewage disposal plant. Harry A. Lewis, chief burgess.

Paterson, N. J.—The matter of constructing the proposed sewerage system in the Lakeview district will probably be taken up in the spring. H. J. Harder, cy. engr.

Colfax, Wash.—The council of Garfield has under consideration the construction of a sewerage plant, comprising over 2 mls. of pipe, a septic tank, 2 filter beds, etc.

Pensacola, Fla.—This city contemplates the construction of storm sewers for the drainage of 40 to 50 acres in the northwestern part of the city. L. Earle Thornton, cy. engr.

Belzona, Miss.—Surveys are being made for the construction of a system of sewers, comprising about 4 or 5 mls. of pipe sewers, discharging into the Yazoo river.

Detroit, Mich.—J. J. Haarer, comr. pub. wks., advocates the construction of 2 trunk sewers, one in the western and one in the northwestern sections of the city.

Portland, Ore.—A resolution has been adopted for constructing a sewerage system in E. 3rd st., Union, Grand and other avenues and streets. J. W. Morris, cy. engr.

Pittsfield, Mass.—In his annual message the mayor recommends the construction of a sewer from Elm st., near Root Place, southeasterly to the river, and easterly along the river front into the Lakewood tract.

Bellefontaine, O.—The city solicitor has been directed to prepare a resolution authorizing the director of public works to employ an engineer to prepare plans and specifications for a sewerage system and disposal plant.

Rochester, N. Y.—E. A. Fisher, cy. engr., has completed surveys and investigations for a new sewage disposal system, which provides for carrying the sewage direct to the lake after passing through a reduction plant to be built at Irondequoit.

Harrisburg, Pa.—Mayor Meals has signed the $1,041,000 loan bill, providing for an intercepting sewer along the river front, additional street sewers, paving of intersections, improvement of Paxton creek, and building a bridge at 13th and one at Walnut sts.

CONTRACTS TO BE LET.

Iowa City, Ia.—Bids are asked until May 6 for constructing a sewere in Walnut st.

Kent, Wash.—Bids are asked until Feb. 7 for installing a number of lateral sewers. Cy. clk.

Chicago, Ill.—Bids are asked until Feb. 2 for constructing 2,340 ft. of conduit. I. J. Bryan, clk. san. dist.

Louisville, O.—Bids are asked until Feb. 7 for constructing sewers and sewage disposal works. Harry L. Rebrassier, vil. clk.

Lawton, Okla.—Bids are asked until Feb. 16 for constructing a sanitary sewer system for the north addition to this city. John D. Kennard, C. E.

Syracuse, N. Y.—Bids are asked until April 1 for constructing 3 mls. of Harbor Brook improvement, including the construction of an intercepting sewer. Intercepting sewer bd.

St. Louis, Mo.—Bids are asked until Feb. 11 for constructing a new 5 to 11-ft. concrete and brick sewer in the new North Harlem Creek joint sewer dist. Maxime Reher, prest. B. P. I.

El Paso, Tex.—Bids are asked until Feb. 3 for constructing incinerating and sewage pumping station, force main and sewage disposal works, with appurtenances, etc. Percy McGhee, cy. clk.

Toronto, Ont.—Bids are asked until Feb. 15 for constructing sewer outlet, sewage tanks, supply of sludge valves, penstocks, special tile, c. i. pipe, etc. Bids by registered post only. Jos. Oliver, chmn bd. control.

Baltimore, Md.—Bids are asked until Feb. 9 for constructing contracts 46, 47, 48, 49 and 9, sanitary sewer system, including power and pump houses, conduits, circular drains, etc. C. W. Hendrick, ch. engr. sewer com.

Woodson, Ark.—Bids are asked until Feb. 9 for constructing 9 mls. of levee, requiring 165,700 cu. yds. of excavation, 8 culverts, 8 gates, floodgate and reinforced concrete. Woodson Levee Dist., at office of Lund & Hill, 201½ W. 2nd st., Little Rock.

Washington, N. J.—Sealed bids are asked until Feb. 14 for constructing about 8 mls. of vitrified pipe sewers, 8 to 18 in.,

with Y branches, manholes, flush tanks, and other necessary appurtenances, and sewage disposal works. Dr. G. B. Smith, mayor; A. J. Craft, boro clk.

Canby, Minn.—Bids are asked until Feb. 8 for constructing 8,600 ft. 6-in., 8,400 ft. 8-in., 1,200 ft. 10-in., 1,450 ft. 4-in., 4,075 ft. 6-in., 350 ft. 8-in., 800 ft. 10-in. tile sub-drain, 50 manholes, sewage settling tank, gasoline engine, centrifugal pump, sewage well and pump house. P. O. Sherrum, cy. recdr.

CONTRACTS AWARDED.

Bakersfield, Cal.—The contract for constructing a septic tank was awarded to Sam G. Smart, for $14,500.

St. Paul, Minn.—The contract for constructing a sewer in Otto ave. was awarded to John Lind, for $6,973.

Claremore, Okla.—The contract for building a sewer in an alley was awarded to the New State Paving Co.

Monterey, Cal.—The contract for constructing a storm sewer in Dickman ave. was awarded to John Taufnir.

Chicago, Ill.—The contract for constructing the S. 52nd ave. sewer was awarded to the Federal Improvement Co., for $288,040.

San Francisco, Cal.—The Metropolitan Construction Co. was awarded the contract for constructing a sewer in Fulton st., for $58,937.

Syracuse, N. Y.—The contract for constructing the Harbor Brook intercepting sewer was awarded to Chas. T. Hookaway, for $4,714.70.

Lincoln, Neb.—The contract for constructing a reinforced concrete conduit for Antelope creek was awarded to C. D. Campbell, of this city, for $39,900.

Raymond, Miss.—The contract for installing a tank and sewer system for the court house and jail was awarded to H. D. Gaston, of Jackson, Miss., for $4,500.

Sapulpa, Okla.—The contract for constructing a brick trunk sewer was awarded, Jan. 10, to Summers & Stone, 312 Security bldg., Oklahoma City.

Milwaukee, Wis.—The contract for constructing a concrete relief sewer in Brown st. has been awarded to G. E. Zimmerman, of this city, for $18,793.

Chickasha, Okla.—The contract for constructing a storm concrete sewer, brick and vitrified pipe, was awarded to T. W. Roberts, of this city, for $38,870.

Muskegon, Mich.—The contract for constructing 8 mis. of sewers was awarded to George C. Berkey, of the Northern Construction Co., of Elkhart, Ind., for $45,000.

Lawrence, Kans.—The contract for constructing 1,500 ft. of sewer was awarded to Graeber Bros., at 55 cts. a ft., $80 for flush tank; galvanized water pipe, 22 cts. a ft.

Clinton, Ill.—The contract for constructing a tile drainage ditch in the Wapella and Clintonia drainage dist. No. 1 was awarded to H. S. Walter, of Cisco, Ill., for $13,000.

Dormont, Pa.—The contract for constructing a sanitary sewerage system was awarded to the Sawders Paving & Construction Co., 26th st. and Allegheny Valley Ry., Pittsburg, for $27,000.

Alliance, O.—The contract for constructing 2 mis. of sewer in Broadway was awarded to J. O'Neil, of Akron, O., for $28,043, and the contract for the sewage disposal plant to J. C. Devine, of this city, for $92,003.

Detroit, Mich.—Bids were opened Jan. 5 for furnishing and erecting machinery for a sewage pumping station located at the foot of Parkview ave., to include 2 centrifugal pumps, boilers and other machinery, as follows: Keating Bros., Detroit, $122,450; Camden Iron Works, Camden, N. J., $112,500; Allis-Chalmers Co., Milwaukee, Wis., $118,900.

Holton, Kans.—The contract for constructing a sewerage system and disposal plant was awarded, Jan. 13, to S. M. Kerns, of Denver, Col., for $41,365.94.

WATER WORKS.

San Diego, Cal.—This city laid 41½ mis. of water mains during 1909.

Houston, Tex.—An ordinance has been introduced providing for the reduction of water meter rates from 30 to 15 cts. per thousand gallons.

Trenton, N. J.—The Municipal Filtration Co., of Philadelphia, has been incorporated to construct and equip reservoirs, filters, irrigation plants, sewerage systems and sanitary water plants, by James B. Lockbridge, Philadelphia; Eccleston Barnett, New York City; Wm. H. Banker, Passaic.

CONTEMPLATED WORK.

Graham, Tex.—A filtration plant is proposed.

Morristown, Tenn.—This city will extend the water mains.

Sodus, N. Y.—A water works system is proposed.

Cheraw, S. C.—A water works system is contemplated.

Quincy, Ill.—The purchase of a new pump is contemplated.

Wilson, Kans.—Plans are being prepared for a water works system.

Flint, Mich.—The installation of a new pump has been recommended.

Edison, Ga.—Voted to issue bonds for constructing a water works system.

Aurora, Ore.—The construction of a small water works system is contemplated.

Gadsden, Ala.—Council has asked for $75,000 to extend the water works system.

Bessemer, Ala.—This city voted to purchase the water works plant for $500,000.

McAlester, Okla.—Voted to issue bonds for constructing a water works system.

Rosenberg, Tex.—The question of constructing a water works system is being discussed.

Red Hill, Pa.—Voted to issue bonds for constructing a municipal water works system.

Plaquemine, La.—The water works system, recently destroyed by fire, will be rebuilt.

Cottage Grove, Ore.—Plans have been completed for the proposed gravity water system.

Manchester, N. Y.—The construction of a municipal water works system is contemplated.

Edinboro, Pa.—Will vote Feb. 15 on the issue of bonds for installing a water works system.

Waterloo, N. Y.—Will vote Feb. 8 on the question of the improvement of the water supply.

Farmington, N. Y.—Will vote soon on the issue of bonds for constructing a water works system.

Manchester, Conn.—A new water supply system, preferably an artesian well system, is proposed.

Salt Lake City, Utah.—The construction of a large number of water mains has been recommended.

Drain, Ore.—Will vote soon on the issue of bonds for constructing a water works system and sewers.

Prosser, Wash.—This city will issue $30,000 bonds for installing a water works and sewer system.

Pella, Ia.—A water works system is

contemplated, although nothing definite has yet been decided upon.

Cherokee, Kans.—Voted to issue bonds for constructing a water works system. M. Reid, chmn. water com.

Leon, Ia.—Bids may be received about Mar. 1 for constructing a water works system. S. A. Gates, mayor.

Brigham City, Utah.—Will vote Feb. 8 on the issue of bonds for installing a municipal water works system.

Mountain View, Okla.—Preliminary plans are being made for a water works, sewer and electric light system.

Pittsburg, Pa.—An ordinance was passed Jan. 10 providing for 2 sets of pumping machinery for the filtration plant.

Shellman, Ga.—The installation of an air-lift pump, reservoir and the extension of the water mains is contemplated.

Kansas City, Kans.—Will vote soon on the issue of $500,000 bonds for the improvement of the water works system.

San Francisco, Cal.—Voted to issue $45,000,000 bonds for the development of the Lake Eleanor-Tuolumne river water supply.

Sacramento, Cal.—In his annual message Mayor M. R. Beard recommends that the Holly pump at the water works be replaced by a new pump.

Albion, N. Y.—The taxpayers voted, Jan. 20, to raise $2,500 for use in trying to locate sources of water supply for supplying this village.

Toledo, O.—The council committee on public improvements approved, Jan. 12, the ordinance providing for a high-pressure fire main system for the down-town district. Geo. W. Towson, cy. engr.

Kansas City, Mo.—Plans and specifications for a new 48-in. intake pipe from the Missouri river to the Quindaro pumping station have been authorized by the fire and water board. Wm. Clough, cy. clk.

Denison, Tex.—(Special.)—W. B. Berry, supt. Denison City W. W., says this city is planning an extension of tunnels for increased water supply. Information regarding channel machines and drills is desired.

San Diego, Cal.—The question of voting on the issue of $1,000,000 bonds for constructing a municipal office building, erecting 3 fire engine stations, N st. conduit, laying water mains, sewers, etc., is being considered.

St. Joseph, Mich.—(Special.)—A. W. Osborn, supt. W. W., advises us that the bd. of pub. wks. has been directed to prepare plans, specifications and estimates of cost for constructing a purification plant for the water works system.

Ridgway, Pa.—(Special.)—H. B. Norton, chmn. water com., advises us that this borough is in the market for the following: One 125-h. p. gas engine; one multistate or triplex power pump; four quills, with pulleys and clutches; two belts, 22 in. by 60 ft.; one 8-in. float valve.

Warren, O.—B. C. Smith, cy. engr., advises us that the election to be held Jan. 15, to vote on the issue of $250,000 bonds for water works, has been postponed. An attempt will now be made to secure better rates from the private company now operating, and in case of failure in this, the taxpayers will then be asked to vote on a bond issue for a municipal water plant.

CONTRACTS TO BE LET.

Burlington, Ia.—Bids are asked until Feb. 2 for constructing a pumping station. Co. supvrs.

Midland, Tex.—Bids are asked until Feb. 15 for constructing a water works system. J. H. Haley, mayor.

Milford, Ia.—Bids will be received about Mar. 1 for constructing a water works system. W. M. Qualfe, mayor.

Toronto, Ont.—Bids are asked until Feb. 15 for furnishing c. i. pipe, iron castings, special tile, etc. Jos. Oliver, chmn. bd. control.

Salt Lake City, Utah—Bids are asked until Feb. 4 for constructing the City Creek aqueduct, including dam for catchbasins, and excavation for settling pond above dam. Geo. F. McGonigle, cy. engr.

Dallas, Tex.—Bids are asked until Feb. 16 for constructing the foundation for the pumping station, building the dam, spillway, and other appurtenances at White Rock reservoir site. J. B. Winslett, cy. secy.

CONTRACTS AWARDED.

Gotebo, Okla.—F. C. Brooke & Sons, of Jackson, Mich., secured the contract for constructing a water works system, for $24,180.

Bryan, Tex.—A franchise for a water works and electric light system has been granted a Mr. Cleaver and associates, of Houston, Tex.

Plattsburg, N. Y.—The contract for constructing a new reservoir dam on Meade brook was awarded to J. J. Fitzpatrick & Sons, for about $31,000.

Wheeling, W. Va.—A contract for erecting a stone pump house and drill a well was awarded to the J. A. Swingle Co., of Zanesville, O., for $89,316.

Buffalo, N. Y.—The contract for the extension of the Pearl st. pipe line to connect with the terminus at Washington st. was awarded to Fred I. Mumm, of this city, for $6,549.

Parkersburg, W. Va.—This city has awarded contracts as follows: Water pipe, Cantrel Construction Co., of this city, $12,131; hydrants, valves, etc., James B. Clow & Sons, $4,504.

Chickasha, Okla.—The contract for constructing water pipe, setting special castings and hydrants, and the extension of the distribution system, was awarded to C. P. Hollingsworth, of this city, for $8,369.20.

Colusa, Cal.—Contracts were awarded, Jan. 3, for constructing water works, as follows: To Standard Eng. Co., 503 Market st., San Francisco, for 85 ft. 10-in. c. i. pipe, $1.49; 6,395 ft. 8-in., $1.11; 33,160 ft. 4-in., 56 cts.; 4,320 ft. 3-in., 29 cts., and 1,980 2-in., 18 cts.; wells, $1,270, and fittings on distributing system, $3,136; and to F. C. Roberts & Co., 461 Market st., San Francisco, for pumping station, $9,978, and tank and tower, $6,100; total for entire plant, $47,935.

BRIDGES.

Troy, Minn.—Bids are asked until Feb. 5 for constructing bridges. A. E. Sinks, co. audt.

Yankton, S. D.—Bids are asked until Feb. 3 for constructing bridges. David M. Finnegan, co. audt.

Cleveland, O.—Bids are asked until Feb. 5 for bridge work. John F. Goldenbogen, clk co. comrs.

Oak Harbor, O.—Bids are asked until Feb. 8 for bridge work. W. H. Mylander, co. audt., Port Clinton.

Portland, Ore.—Plans have been adopted by the city council for constructing a high bridge at Broadway st.

Indianapolis, Ind.—The county commissioners have decided to build a number of bridges, at an estimated cost of $400,000.

Dayton, O.—The citizens of North Dayton have asked the city council to con-

struct a new bridge over Mad river, at Keowee river.

Bloomington, Ind.—Bids are asked until Mar. 9 for constructing steel bridges. Horace Blakely, co. audt.

Duluth, Minn.—Bids are asked until Feb. 8 for constructing steel bridges, with concrete abutments. Odin Holden, co. audt.

West Point, Miss.—Bids are asked until Feb. 8 for constructing a steel trestle. L. J. Howard, clk. bd. supvrs.

Rochester, N. Y.—Plans have been submitted for a reinforced concrete bridge over the river at Central ave., by cy. engr. Fisher.

Chattanooga, Tenn.—The question of repairing McCallie ave. viaduct or constructing an entirely new viaduct is under consideration.

Houston, Tex.—Plans and specifications have been completed for a new bridge across the ship canal, at the foot of San Jacinto st.

Bristol, Va.—Bids are asked until Feb. 8 for constructing a steel or concrete bridge over Beaver creek. Jas. W. Mort, chmn. st. com.

Topeka, Kans.—Bids are asked until Feb. 7 for constructing a bridge across the Shunganunga creek, in Fillmore st. C. B. Burge, cy. clk.

Milwaukee, Wis.—Council has been asked to pass a resolution submitting to vote a bond issue for constructing a new bridge across Milwaukee river.

Shreveport, La.—The city council has adopted an ordinance providing for the construction of a free wagon bridge across Red river between this city and Bossier City.

Columbus, Ga.—The city council has adopted an ordinance calling for an election to issue $100,000 bonds for building a new bridge avross the Chattahoochee river. The election will be held Feb. 16.

Hutchinson, Kas.—(Special). The city commissioners have decided to construct a single, reinforced concrete arch across Cow Creek, at Main and Avenue A. Engineer McLane will prepare plans and bids will be asked for its construction.

STREET LIGHTING.

Bedford City, Va.—Voted to issue bonds for establishing a hydro-electric plant.

Lompoc, Cal.—A municipal electric light plant is advocated.

Montclair, N. J.—A municipal lighting plant is advocated.

Brach, N. D.—The installation of an electric light plant is proposed here.

Newport Beach, R. I.—The citizens voted to install a municipal gas plant.

San Bernardino, Cal.—A municipal lighting and power plant is contemplated.

Lincoln, Neb.—Plans and specifications for a municipal electric light plant have been completed.

Williston, N. D.—Will vote on the issue of bonds for constructing an electric light plant.

Phenix City (Columbus P. O.), Ga.—This city has decided to install a lighting plant.

Albemarle, N. C.—This city has sold bonds for constructing an electric light plant.

Marianna, Fla.—Voted to issue bonds for the consolidation and enlargement of the electric light and water-works plants.

Tacoma, Wash.—Bids are asked until Feb. 21 for constructing the head-works and tunnel for a hydro-electric power plant on the Nisqually river. H. J. McGregor, comr. pub. wks.

Derry, N. H.—The Derry Electric Light Co. is making arrangements to replace its direct-current machines with 3-phase, 60-cycle, alternating-current generators. D. W. Griffiths, chmn.

Chambersburg, Pa.—(Special). The borough council voted Jan. 3 to spend $19,227 more to equip the electric light plant, without submitting the matter to a vote of the people.

Sylva, N. C.—Plans are being made for erecting an electric light plant on the Huckaselgee river, a short distance from Dillsboro, to furnish electricity for this city and Dillsboro.

Lexington, N. C.—Plans are being considered for changing the system of the municipal electric light plant from direct to alternating current, and purchasing electricity for operating the plant from the Southern Power Co., of Charlotte. Albert L. Couch, supt.

Regina, Sask.—(Special). Augus Smith, cy. engr., advises that this city invites negotiations with capitalists and others for the purpose of obtaining proposals for a special franchise for street car services and gas works for the city, subject to the right of the city to take over the undertaking at the expiration of a definite term of years, at a price to be fixed by arbitration, or in such other manner as may be agreed on.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Washington, D. C.—Supt. Wood, of the street cleaning department, recommends the purchase of 3 street washing machines.

Jeffersonville, Ind.—The contract for sanitary carts was awarded to Geo. A. Holzbog, of this city, at $1,340 for five 4-wheel 2-horse carts and at $2,000 for ten 2-wheel 1-horse carts.

St. Louis, Mo.—Contracts for sprinkling the streets were awarded, Jan. 8, as follows: John F. McMahon, Wainwright bldg., 16th district, $7,993; 17th, $6,521; 19th, $5,315; 20th, $6,487; 22d, $3,943; 23d, $2,909; 24th, $4,681, and 25th, $7,183. Frank A. Stiers, 23d district, $3,585; 30th, $6,336; 33d, $4,940, and 34th, $6,199. G. Eyermann & Bro., 1216 South Grand ave., 15th district. $9,200.

PARKS.

Rochester, N. Y.—A park in the 18th ward is contemplated.

Pekin, Ill.—The enlargement of the park between Court st. and Park ave. is proposed.

FIRE APPARATUS.

Bozeman, Mont.—The Gamewell Fire Alarm and Telegraph Co. bid $2,345 for installing a fire alarm system.

Rochester, N. Y.—The contract for installing 3 new joker outfits for the fire alarm telegraph system was awarded to the National District Telegraph Co., for $340 each.

Crockett, Tex.—The contract for furnishing fire hose, reels, pipes, etc., was awarded to the Fabric Fire Hose Co., of St. Louis.

Joliet, Ill.—The council adopted an ordinance, Jan. 3, providing for a high pressure fire protection system to be installed at a cost of $110,000.

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TOWN SCAVENGING AND REFUSE DISPOSAL.

REFUSE COLLECTION AND DISPOSAL.

By Hugh S. Watson, A. M. I. C. E., London, Eng.

WASTE Paper Service.—Many towns have now adopted the system of attaching galvanized wire baskets to the bases of electric light standards or lamp-posts, in which waste paper may be deposited. The contents of these are in some cases emptied into the ordinary collecting carts which collect the street refuse. In others a separate collection is made, and the paper so collected is sold.

In Liverpool 406 tons of paper were collected in the year 1906 in baskets of this description, and this was sold at the rate of 12/6 ($3) a ton, the total receipts for the year being £254 ($1,232), while the cost of collection was £151 ($732), the net profit being £103 ($500). Councillor Muirhead, of Liverpool, when speaking at the Annual Conference of the Institute of Cleansing Superintendents of Great Britain and Ireland, in 1908, stated that the net profit from this source had amounted to about £300 ($1,500); presumably this referred to the year 1907.

In Glasgow a separate collection of waste paper is made. Bags for holding the paper are issued to offices, other business premises and better class dwelling houses, and are called for as often as necessary. Covered vans are used for the collection of the waste paper. In his last annual report Mr. D. M'Coll, the cleansing superintendent, states that the amount realized from the special watse paper service amounted to £640.16.7 ($3,108).

In Newcastle-upon-Tyne 32 boys are employed solely to pick up paper from the streets, and in 1906 about 150 tons was collected in this manner, the whole of which was destroyed. A separate paper collection is made from shops and business premises, the amount collected being about 220 sacks per day. This is sorted by girls, put into pressed bales and sold. During the year 1906 the quantity disposed of was 340 tons, which realized roughly £300 ($1,500) at a small margin of profit.

Collection of House Refuse.—This is in all cases carried out in the day time, the work being started early in the morning. Although the by-laws of the London County Council only provide for the collection of house refuse once a week, it is the general custom of sanitary authorities in London and in many provincial towns to make a daily collection, where the necessity for the same arises, as for instance in the case of hotels, factories, restaurants and markets. Where a daily collection is in force the inhabitants are generally required to use covered galvanized iron bins and to place them on the edge of the curb in front of their premises. In many boroughs in London the commissioner of police requires that the refuse shall be removed from certain streets by 10 A. M., on account of the obstruction caused to traffic.

Where the collections are only made weekly, the bins must be placed in accessible positions, from which they can be removed by the dustmen. They are generally placed in the areas in front of houses, where such exist, and in the case of shops they are often retained in the cellars and passed up through trap doors, opening onto the street, a small lift being used to raise the bins.

In Liverpool a special form of bin designed by Mr. Brodie, the city engineer, is in use. This consists of a cast iron frame, which is built into the back passage wall of the premises. The bin itself fit into the frame, and projects slightly into the yard, so that ashes and refuse can be easily deposited therein. To remove the receptacle it is necessary to use a special handle which engages with studs projecting on either side of the bin.

In some towns special air-tight bins

are supplied for the reception of refuse from butchers and fishmongers' premises.

There are two methods of collection in common use. One is to send out carts singly, under the control of drivers only, who are provided with small receptacles into which they may empty a part of the contents of any house bin that they may find too much for their strength. The other is to send the carts out in pairs, accompanied by an additional scavenger. When the first cart has been filled it is taken by the driver to the nearest depot, the scavenger remaining behind to assist in the filling of the second cart. If the distance from the place of collection to the depot is not very far, the first cart should have returned by the time the second cart has been filled. When the carts have to travel long distances, however, this system will not be found economical, as the scavenger will be standing idle during the time the carts are both absent.

As a rule the whole of the contents of the house bins are emptied direct into the carts, and any sorting that may be performed, to recover articles having a marketable value, is carried out at the disposal works. Occasionally, however, baskets are slung on to the backs of the carts, in which tins and scrap iron, etc., may be placed at the time of collection, so as to save any subsequent sorting.

It is usual to place a little disinfectant in each bin after it has been emptied.

Mr. Allen Vickers, the cleansing superintendent, has found that in the borough of Battersea a van holding 2½ cubic yards can take the contents of about 68 portable bins, that is to say, that one cubic foot of refuse is removed from each bin.

The vans work in gangs of four, a helper being attached to every two vans, and they make an average of 3 loads per day, so that each van can deal roughly with the refuse of about 200 tenements.

Removal of Trade Refuse.—Under the Public Health Act, London, 1891, sanitary authorities are required to remove trade refuse from any premises when requested to do so by the owner or occupier, but the owner or occupier shall pay for the removal of such matter. In the City of London a charge of 7/6 ($1.80) per ton is made for removing refuse from the various markets. In the Metropolitan borough of Finsbury trade refuse is disposed of at the rate of 2d (4 cents) a bushel if collected from private premises, and 1d (2 cents) a bushel if deposited at the local authority's depot. The term "trade refuse" includes the droppings from costermongers' barrows and stalls, for which they are made to pay at the above rates. A charge of 2d (4 cents) per cwt. for quantities weighing less than 10 cwt. and 2/— (24 cents) per ton for quantities of over 10 cwt. is made for the disposal of trade refuse in Salford, but an exception is made in connection with the green grocers and fish trade, in order that these tradesmen may not be encouraged to store this refuse, and thus create a nuisance and a danger to the public health. Refuse from these forms of business is destroyed free of charge when it is brought to the depots.

"Trade refuse" is defined under the act as "refuse of any trade, manufacture, or of any building materials," but it is very difficult to state exactly what comes under these terms. It appears, however, that no refuse is considered as trade refuse unless a direct profit is made from the matter of which the refuse removed is merely the waste.

Disposal of Street Refuse.—Road sweepings are disposed of in a variety of manners. In many towns the street sweepings are used as manure in the public parks and gardens, and the surplus that cannot be disposed of in this manner is either sold or given to farmers, who use it for the same purpose.

Much of the road sweepings of London is barged to the mouth of the river, and is utilized to fill up the holes from which brick earth has been removed, in the various brick-fields situated thereabouts. The land at the mouth of the river is, generally speaking, very low lying, so that the level is generally made up considerably higher than the original level in order to prevent flooding. The ground is allowed to run wild for a year or two, and is afterwards put into cultivation, when splendid crops can be taken off it.

In some seaside towns, such as Dover, the proportion of road sweepings which cannot be disposed of or utilized as manure is conveyed to sea. In the year 1904, of 8,491 loads collected, 1,679 were disposed of in this manner.

In very few cases are road sweepings dealt with at destructor works, owing to the difficulty of burning them, particularly in wet weather, when they consist largely of slop. If the sweepings have to be barged or railed, it is advisable, generally, to store the material for a short time previously, in order to allow any water to drain away.

NEW STATISTICS OF CITIES BY THE CENSUS DEPARTMENT.

By Don E. Mowry, Madison, Wis.

EDANA DURAND, Director of the Census, has just issued the abstract of the annual report on statistics of cities having a population of over 30,000 for the year 1907. This report contains the more important data relating to the activities of municipal governments, and is published in advance of the detailed report, which will appear in the near future. In addition to the tables presented in the abstract, the detailed report will contain 30 tables for the detailed presentation and analysis of the financial data, together with 25 tables relating to departmental equipments, employes and activities. The abstract was prepared under the supervision of Mr. Le Grand Powers, chief statistician in charge of official statistics of cities.

The sixteen tables of the abstract present, in a comparable form, the following data relating to the financial transactions and conditions of municipalities: The total and per capita costs of government and the similar costs of maintaining specified public services; the total costs of constructing and maintaining sewers, streets, etc., and the average cost per standard unit of work performed; the total, and per capita revenue derived from all sources and from each specified source; and the proportion of the total revenue derived from each source, and the total expenditudes made for each object or purpose.

Great differences were found to exist in the organization of American cities for purpose of local self-government. In some cities practically all municipal activities are administered by a city government having one executive head and a single set of financial officers, the various departments of municipal activity in such cases being subject to one control or supervision, and all persons engaged therein receiving their compensation through the same channel. In other cities the administration of municipal functions is distributed among a number of more or less independent but correlated branches or bodies, of which the one performing the most important functions is usually spoken of as the city corporation.

The government of the city—that is, of the community constituting the city—for which data were obtained in order to compile comparable statistics of financial transactions and conditions, was not limited to the "city corporation," but included all corporations, organizations, commissions, boards, and other authorities through which the people of the city exercised any privilege of local self-government, or by which they enjoyed the exclusive benefits of any governmental function.

For purposes of comparison, the cities are grouped in four classes, as in former reports on cities. I includes cities with a population of 300,000 or over; II, 100,000 to 300,000; III, 50,000 to 100,000; and IV, 30,000 to 50,000.

In order to bring out the value of these yearly reports, which the Census Bureau has been issuing, I have gone over the present abstract with a view of making some comparisons in nine of our leading cities, namely, Baltimore, Cleveland, Buffalo, Pittsburg, Detroit, Cincinnati, Milwaukee, New Orleans and Washington, D. C.

Baltimore is the largest city of the group (over 553,000), but there are five other cities that have a greater total area in acres. The total outlay per capita is smaller than it is in six of the other cities. New Orleans is the only city that spends more for health and sanitation. For highways and education Baltimore's per capita outlay is small. Her recreation and public service outlays are among the best. The outstanding gross debt is smaller than that of Cincinnati—and Cincinnati's population, in 1907, was about 350,000. Baltimore's net debt per capita at the close of the year was smaller than that of Cincinnati and New Orleans. Pittsburg has a greater assessed valuation. The police force of Baltimore is the largest in the group. More arrests, for all causes, were made in Pittsburg. The Baltimore appropriation for the fire department was considerably more than that made in any other city, yet Buffalo, Pittsburg and Detroit employed more men in this branch of the city service.

From the rough table which I have before me similar comparisons might be made for all of the cities of this group which I have selected at random. However, I believe I have illustrated the value of these government statistics to those who are interested in mak-

ing these comparisons in the interest of their own city. I will therefore cite only some of the salient features which my table, based upon the abstract, reveals:

Cleveland has a large number of arrests in proportion to her population. Buffalo spends the least for health, sanitation and recreation. Pittsburg employs the largest number of men in her fire department and spends the most money for all general and special services. Detroit's gross and net debt outstanding at the close of the year is nearly as small as that of Milwaukee. While Cincinnati spends the most for education, due, in part, to the fact that she is largely responsible for the upkeep of the University of Cincinnati, her debt is far in excess of any other city of her own size. Milwaukee still leads in the lowest number of arrests, the lowest per capita outlay and the lowest gross and net debt outstanding at the close of the year. New Orleans has the largest per capita outlay and spends the most money per capita for public service enterprises. She spends the least for police protection and only 0.50 per cent. per capita on her highways. Washington spends the most for her highways because she has the greatest area, nearly double the amount of any other city in the group. Her outlay for health, sanitation and education is considerable.

If you are interested in the pavements of cities you will want to examine Table 15 of the abstract. Buffalo has more asphalt and asphalt block area than either Washington or San Francisco. In Cleveland there is less of this sort of pavement than in any of the nine cities mentioned in the group I have chosen for this brief analysis. Milwaukee has the greatest area of macadam, over five million square yards. Baltimore has an equal amount of cobble stone. Cleveland takes first rank for area in brick paved streets, and Pittsburg for granite and Belgian block streets. Nevertheless, Pittsburg has more miles of unimproved streets than any of the other cities. In this same connection it is interesting to note that Cleveland has abolished the largest number of grade crossings during the year.

The abstract which I have before me is Bulletin No. 105, and any one who is interested in the statistical facts presented can secure a copy of the same by writing to E. Dana Durand, Director of the Census, at Washington, who, I am sure, will be glad to mail the report if the supply is not already exhausted.

REINFORCED CONCRETE BRIDGES FOR COUNTRY ROADS.

By J. G. McMillan, C. E., County Surveyor. San Jose, Cal.

CONCRETE bridges are rapidly replacing the old style wooden and steel bridges, which formerly were a conspicuous but not altogether an attractive part of our county roads. The wooden bridge is no longer seriously considered by a wide-awake board of supervisors which realizes the many advantages of a reinforced concrete or cement structure.

There is no field of construction in which the use of concrete appeals more strongly to the practical business sense of the farmer than the building of highway bridges. The flimsy and unsightly bridge structures of wood and steel are really more expensive in the end than bridges and culverts of concrete, which are at once beautiful, permanent and fireproof and require no painting or repairs. The somewhat higher initial cost of concrete bridges in some localities has retarded their adoption, but the vastly superior advantages of concrete cannot fail to ultimately impress the intelligent judgment of American farmers generally.

Concrete bridges were initiated into Santa Clara county in 1891, the first being a four-ring brick arch laid in Portland cement mortar, the side walls and foundation being of gravel concrete and boulders. There was one span, 36 feet long, with a 24-foot roadway. At the time the contract was let for this bridge, bids were also received on other plans, viz.: Two bids for a wooden bridge, $490 and $681; also one bid for a combination bridge, $690, and one bid for a wooden bridge with concrete piers for $971. The bid with concrete structure was for $1,025. The contract was let for $1,000, the deduction being made in consideration that

CONCRETE BRIDGE OVER LOS GATOS CREEK AT ALMA.

Cost $2,843. Span 40 feet. Roadway 20 feet.

the contractor leave off the plaster finish on the concrete structure.

There are in Santa Clara county between thirty-five and forty concrete and stone bridges of more than 20 feet span.

The designs are made in harmony with the locality.

In the foothills and mountains, where boulders and field stones are available, they are worked into the structure not only for harmony, but also as a matter of economy. With the proper use of boulders and field stones a saving can be made in labor and cement of 25 to 30 per cent.

Up to 1902 most of the arches were constructed of brick, laid in cement mortar; nevertheless, plans were submitted and bids received both on brick arches and reinforced concrete arches. Until 1904 the cost was in favor of the brick arch, since which time the cost has been in favor of reinforced concrete.

From 1891 to 1904 the cost of concrete, where sand and gravel were close by, was $5.50 to $6.50 per cubic yard; in 1907 and 1908 the cost ran up to $10 per cubic yard.

All the stone and concrete bridges withstood the earthquake of 1906, whereas many of the steel and combination spans were moved from their foundations.

So far all expense for maintenance has been eliminated.

In the East and Middle West many of the county boards are going on record as champions of concrete bridges in preference to all other materials. In Kansas recently the senate passed a bill which provides that the county boards throughout the State must build concrete or stone bridges in all cases where the cost of a concrete or stone bridge is not more than 30 per cent. in excess of the cost of a steel bridge. This notable piece of legislation is a most striking recognition of the merits of concrete and evidence of the growing conviction that this kind of material is the most satisfactory for bridge construction.

EDITORIAL NOTE.—We are indebted to Mr. McMillan and to *The Architect and Engineer* for the accompanying photographs.

PAVING BLOCK INSPECTION AT THE MANUFACTURING PLANT.*

By W. A. Aiken, M. Am. Soc. C. E., Vice-Pres. Henry S. Spackman Eng. Co., Philadelphia, Pa.

EARLY in the spring of 1909 a contract was made for about two and one-half million paving block by the city of Kingston, N. Y., and the Spackman Engineering Company was employed through a specially appointed committee of the authorities to take charge of the inspection of the material, as well as to lend the author's experience towards the proper execution of the contract for placing the material, to the end that as nearly as possible first-class results should be secured. One marked incident showing appreciation of the value of our experienced service is to be noticed in the request by the local civil service board of Kingston, that the writer draw up the examination papers whereon depended the securing of specially authorized inspectors on the construction, with the result that a number of high class, honest, earnest young men were secured, who as far as possible carried out the intentions of the specifications of the city engineer. One of the first steps taken by the writer of the paper was to place in the hands of those having the care of the construction, copies of your Mr. Blair's pamphlets on pavement construction. While it is not always possible, even though theoretically it should be so, to insure the best, the earnest effort to obtain this must always, as noticeable in this case, give better results than where work is carried on without every safeguard. This is only possible through the employment of disinterested outside parties, to represent public interests irrespective of political factions, which necessarily exist in every community and whose influence, unfortunately, is not always of the best.

The first step in our inspection work was to install at the brick plant a National Brick Manufacturers' Association standard rattling machine. Considerable stock of previous season's manufactured block was tested to determine the permissibility of its use,

*From a paper before the National Paving Brick Manufacturers' Association.

CONCRET EBRIDGE OVER THE CARNADERO CREEK ON THE MONTEREY ROAD NEAR GILROY, CAL.
Cost $12,300.

as undoubtedly contemplated originally by the contractors, which probably largely influenced the authorities of the city of Kingston to provide for such inspection. The product so tested did not prove acceptable, with the result that all block going into the Kingston Broadway improvement was manufactured during the season in which the work was constructed and under our general supervision.

A close study of kiln conditions was early undertaken to determine the height zone therein from which it was likely the better material could be obtained, but, while some general data were accumulated, it was found at the plant in question that not as much positive dependence could be placed on the location of the brick in the kiln as was originally hoped, so as to expedite the sorting and loading of the block. It finally settled down to the manufacturer loading direct from the kilns onto barges, all transportation between the manufacturing site and Kingston being by water, of such material as in his judgment would, by average sample selected therefrom, by ourselves, pass the requirements of the specifications, which called for a maximum abrasion loss of 18 per cent and a maximum absorption of 3 per cent. The question of testing is always more or less a give-and-take proposition. Like all other material, nothing could be absolutely assured unless every block was tested, which, of course, would destroy its usefulness. As the work progressed and the acceptable kiln output was reduced, much dissatisfaction was expressed by the manufacturer at what was claimed to be the rigidness of the inspection, but the samples selected by our representative were never claimed to be unrepresentative and were taken by ourselves only from loaded material culled by him to meet the specifications.

The blocks from each kiln as opened were piled separately on barges, reports of the abrasion tests were regularly forwarded, generally previous to shipment of the material from the brick plant, by our representative to the city engineer at Kingston and an additional ten blocks from each kiln were sent to our Philadelphia laboratory for cross breaking tests for modulus of rupture and specific gravity determination, as well as absorption test. This latter was as severe as need be, being made on the halves of the cross brick which had previously been put through the rattling machine for a certain time to insure approximately specification conditions for each absorption test, viz.: rattled brick.

The question of character of shot material incidentally loomed up on two or three occasions when the brick manufacturers failed to keep a supply of standard shot, and others of specification size and weight, though not of specification quality, were temporarily furnished from local foundries. In one case, chilled material was furnished and the effect of the harder surfaced shot was at once apparent in discordant results on material, which, in our representative's as well as the writer's opinion, should not have been found if the shot had been of standard quality.

Since the object of the inspection was to insure good material and since no specifications should be interpreted to the entire waivure of experienced judgment, some latitude was allowed when such did not necessarily involve the acceptance of poor material. At times material was loaded and shipment made from the last kiln being tested before results were obtained, and under such circumstances samples of the material involved were returned to our representative by the city engineer, with whom final appeal necessarily rested, for additional retests, if the original ones had been unsatisfactory. This only occurred in exceptional cases, and in one resulted in the acceptance of the material, which on original tests would have been rejected, and in others, the retests corroborating original test, resulted in the rejection of the delivered material. Each barge load was diagrammed by our resident inspector, facilitating the selection of material for retests when necessary and the city engineer did not allow the unloading of any material until final action had been taken thereon based on our reports and recommendations.

The advantages of the above described inspection service may be summed up briefly: It insured a supply of accepted material on the work, by preventing the shipment, as a rule, of any block not finally acted upon through tests made before shipment. This obviously is of the greatest advantage to the contractor engaged in laying the pavement by enabling him to make his plans for carrying on the work through knowing in advance the quantity of material he could count upon and obviating the delay incidental to waiting for action on material to be tested after it has been received. It is of as great advantage

CONCRETE BRIDGE OVER SAN FRANCISQUITO CREEK ON POPE STREET, PALO ALTO.
Cost $3,825. Span 50 feet. Roadway 28 feet.

to the block manufacturer in minimizing any loss for rehandling or freight charges both ways, as when material is not tested until after delivery and is subsequently rejected, but far and above this, and of immeasurably more value, it enables him to keep a line on his product and through the daily tests being made on material, involving even possibly slight variations in raw product or details of manufacture, either accidental or intentional, insures the best finished product, providing the resident inspector is, as he should be, an experienced observer, and the manufacturer is prepared to take advantage of all the information to be garnered from these test results. It is of equally great advantage to the municipality's engineer and his corps of inspectors, who, under these ideal conditions, are not obliged to be worried by the constant vigilance necessary to keep rejected material off the work or to prevent any delivery on the work until final test action has been taken. These inspectors are thereby enabled to devote their entire attention to the carrying out of the details of construction as called for by the specifications.

There is no doubt that if inspection at the point of manufacture was generally adopted by municipal authorities, or even by general contractors purchasing block material, through the employment of outside specialists to insure the shipment of nothing but accepted material, thousands of dollars could be saved to all interested parties — the manufacturer, the contractor and the municipality for whom the pavement is to be constructed— through saving in freight charges to the first, possible handling charges to the second, and expediting construction in the case of the two last. The expense amply warrants the adoption of inspection at the manufacturing point. This has been proven in the case of cement inspection, first advanced and adopted by the writer as general inspector of material on the New York subway and now so very largely carried on everywhere in the case of this material, and is herein demonstrated to have been valuable in the case of paving block.

Many interesting features involved in the question of testing paving block were continually noticed during our six months' engagement, only one of which is above referred to, the influence of the quality of the shot material upon final test results. Testing must be resorted to in order to insure quality. Whether the standard tests are those best qualified to accomplish this and whether the present specification requirements are properly correlated, is questionable and certainly open to argument, since many factors are of influence; but as long as certain requirements are admittedly the standards to be met, the effort to comply therewith can most successfully be carried out by intelligent inspection.

PAVING ALONG STREET RAILWAY TRACKS.*

By Thomas B. McMath, Chief Engineer Indianapolis Traction and Terminal Company.

THE pavement in street railway tracks is subject to additional destructive conditions besides those encountered on ordinary streets. The concentrated wheel loads of the modern cars distort and deflect the rail. This breaks any contact the pavement may have with the rail and provides entrance for water into the body of the paving. Heavy, stiff rail with good fastenings and solid ballast reduce deterioration of the paving, but do not prevent the vibration of the rail. This cannot be eliminated.

During the past year in Indianapolis several features in track paving have been studied. The reconstruction of track in the business center of the city presented opportunity for improving the track construction. Two blocks of track on Pennsylvania street between Washington and Ohio streets were rebuilt, using every care to make the work as permanent as possible.

The 9-inch girder rail, 90 pounds to the yard, was laid on 6 by 8-inch white oak ties, spaced 2 feet. The subgrade was excavated to a depth of 10 inches below the bottom of the ties and rolled till compact. The track was raised on blocking to the proper grade and line and the excavation filled with Portland cement concrete to within 5 inches of the top of the rail and allowed to set for ten days. Brick surface was applied on a sand cushion. At the street

*From a paper before the Central Electric Railway Association.

BRIDGE OVER LLAGAS AT OLD GILROY.

Span 32 feet. Roadway 20 feet. Cost $2,950. Built 1902.

intersection where traffic could not be kept off, the brick was filled with asphaltum filler. The balance of the paving was grouted with Portland cement, every effort being made to fill the joints completely with grout.

The new features of this track construction are the increased thickness of Portland concrete base under the ties, and the use of the beveled edge Nelsonville stretcher brick outside of the track.

Objection may be made to the use of the stretcher brick outside the rail, as this may start a rut along the rail. The bevel stretcher in combination with the wood strip under the head of the rail is intended to keep the rail from direct contact with the brick and to reduce the effect of vibration and prevent the paving being crushed by wide tread wheels.

Asphaltum filler has been used on brick paving in Indianapolis and has its advantages in cases where traffic cannot be kept off the paving or tracks for sufficient time to permit cement grout to fully set. Several makes of asphaltum filler have been tried, as well as coal tar pitch. Later we will have some data as to their relative merits.

About 8,000 square yards of brick paving was filled with asphaltum filler during 1908. This paving is subjected to heavy traffic and great effort was made to do as good a job as possible. The work was done with every precaution suggested by the representative of the asphaltum, the city engineer, and the engineering department of the street railway to make it first class. Two blocks of the same stretch of track are grouted with Portland cement. A direct comparison of results can be made. At present both stretches of paving are in fine shape.

The wear on brick paving starts from the breaking of the edges of the brick at the joints, rounding the edges till the brick resemble cobble stones. This is noticed especially when the wear is from the shoes of the animals, the wear from wheels being practically uniform across the face of the brick. The round edge commonly used is a mistake. Brick should have as little rounding as possible on the edges.

The greatest possible effort should be made to fill the joints full with the best grout. Ordinary grouting is the ruin of a brick. Five cents a square yard spent on good grouting is the best investment on the job. In going over pavement it will be seen that the best paving is that in which the grouting is best. The city engineer and myself have seen parts of brick pavement that have kept smooth under heavy traffic when the balance of the paving was worn rough; the only explanation for the different condition was the grouting.

The following method is suggested for grouting: Mix 1 to 1 cement and sand in a box, using always a measured amount of sand, cement and water. Mix thoroughly and dump the box. Sweep the grout on diagonal lines and use a rubber squilgee instead of a broom. After the grout has settled down in the joint go over it again, repeating until the joint is full and flush after the initial set.

The price paid for brick is probably too low; a smaller brick more uniform in structure and burn is preferable. Such brick should be very closely inspected; possibly 40 per cent of the brick now classed as No. 1 should be rejected. If the size were smaller, these brick would be used in building, thus providing against loss to the maker. The manufacturer should grade his product to give the customer the qualities needed and himself reject the poor brick.

Inspection for quality as the brick are laid is unjust to both parties. As the eye can only decide shape, color and possibly absorption of water, many brick that would be satisfactory are rejected and unsatisfactory brick are scattered throughout the paving. The inspector should have the advantage of judging the brick from their position in the kiln. A better market for second-class brick will have to be found before the manufacturer can be expected to grade closer or else the price must be better. Both the manufacturer and his customer should be insured against the expense of freight, unloading, hauling and storage on rejected brick.

Up to the present time no granite or stone block pavement has been used in Indianapolis. The traffic, however, on several streets now paved with brick is so heavy that a block pavement is needed. The street railway has 8,000 square yards of block pavement under construction on Kentucky avenue south of White river.

The block selected is from quarries sixty miles east of Pittsburg and known as Ligonier block. This is a very tough limestone. The block is laid on concrete foundation and the joints filled with pitch. The pitch to be used will be hydrolene 80 per cent and residuum oil 20 per cent. The

Concrete and Stone Bridge
Main Street, Los Gatos, California
Length 180 feet, Height 50 feet, Roadway 70 feet
J.G. McMillan, Engineer.

CONCRETE AND STONE BRIDGE, MAIN STREET, LOS GATOS, CAL.
J. G. McMillan, Engineer.

stone blocks are smoothly cut and the pavement will not be materially rougher than brick. The block does not glaze nor get slippery under traffic. Block will eventually cobble where exposed only to horse travel, but if laid smooth will remain so under wheel traffic if fully grouted. The secret of a good block pavement is in the cutting of the blocks with smooth faces and square edges; the block must be laid close with the joints filled with filler. If the pavement be as smooth as brick, the noise would be obviated largely and the pavement would continue smooth even when worn by traffic.

For railway track paving, stone block has the great advantage that the paving can be replaced after track repairs at small expense and the general condition of the street is not impaired as in asphalt or brick surface.

The maintenance of track and paving always presents the difficulty that a minor repair to track cannot be made without a large paving expense. In other cases reconstruction of the paving cannot be made because the condition of the track will not justify it and enough money to rebuild both is not at hand. In other words, a worn-out pavement on a street with a two-thirds worn-out track presents a difficult financial problem. There should be some cheap pavement invented to use for such short time work. This problem is frequently presented on interurban lines in small towns in which ordinary tee-rail construction should be paved.

The success of pavements of the bitulithic class seems to indicate that something can be expected in this direction. Assuming that the track roadbed is good enough for a foundation, if a 4 or 5-inch layer of bituminous macadam could be cheaply laid and cheaply and easily be repaired by ordinary section men, it would solve this trouble. The patents seem to tend to prevent the use of the usual forms of such pavements under these conditions.

One proposition of this kind is presented by an asphalt contractor. He suggests a layer of clean macadam laid and rolled in place with a light roller, then poured with a hot asphalt. This is to be followed with a layer of ¼-inch stone also poured with hot asphalt, then coated with sand and cement and rolled with a heavy roller.

For this proposition no great plant would be required. A closed heating kettle of two tons capacity with a hand agitator can be purchased for $700. The grading of the macadam can be cheaply done. It has been estimated that such a pavement could be laid at 50 cents per square yard, and subsequent patching could be done by section men at the same cost. This would give a pavement suitable for light traveled streets where the traffic largely avoids the car tracks. The cost of maintenance would be so small that it would not be neglected.

THE DEEP WELL WATER SUPPLY OF SOUTH BEND, INDIANA.*

By Alonzo J. Hammond, Consulting Engineer, South Bend, Ind.

OF the valuable assets which have been given by a kind providence to many of the cities of Indiana, the one of perhaps the most value is a supply of pure water from deep or artesian wells, and the one city peculiarly favored is South Bend.

Many of the cities which have depended on their deep well supply for a number of years have found the flow gradually decreasing, the effective head growing less, placing a greater burden on the pumps for a suction lift, in many cases requiring some type of deep well pump to force the water from a depth below the limit of suction of the piston pump, and requiring the drilling of new wells over a wider field, but it is particularly true that the static head has become less, and the field is fertile for the air lift, the centrifugal or screw pump which can be put into a small well casing.

The wells found along the St. Joseph river in northern Indiana have a strong hydrostatic pressure, those in South Bend particularly so.

By some strange upheaval during the glacial period, the course of the St. Joseph river was changed from a southwesterly direction through the Kankakee and the Illinois river drainage system to a northwesterly route, reaching Lake Michigan for an outlet.

Heavy deposits of gravel are found at and near South Bend, and along the

*A Paper before the Indiana Engineering Society.

LONG BRIDGE ON SARATOGA TURNPIKE.

Cost $8,347. Two 60-foot Arches.

river channel an average vertical section penetrating the water-bearing gravel may be as follows, this being a vertical section of a ten-inch well drilled in 1906 at the Central station. Measuring down from the surface, there is fourteen feet of top soil, then fifty-nine feet of impervious blue clay of a fine texture, which material has been largely used in the manufacture of building and paving brick, burning white. Below the clay is nine feet of compact sand, and then twenty-eight feet of coarse gravel, which is water bearing, make a total depth of 110 feet. This section is typical only, as the actual depths and thicknesses of the different strata vary widely, and the total depths vary from 85 feet to 125 feet.

The source of water supply to this stratum of gravel has been conjectural, one assumption being that it is supplied from gravel deposits lying northeasterly from the city, another that its source is the river, the percolation going on at some point well up the river from South Bend.

It is barely possible that the latter theory is correct, and that the stratum leading to the one at South Bend is very limited in extent, because of the fact that numerous borings a few miles above have so far failed to locate any similar suppiy of water.

The following data as to the static head of the wells indicate a gradual dropping off of hydrostatic pressure as the location of the wells is carried down stream.

At Springbrook Park, about two miles above the central station (and I may say that the central station is within one block of the business center of the city), the static head of a two-inch well is at an elevation of 32.00 city datum. At the central pumping station the static head is 28.00 city datum; at the north pumping station, which is about 3,000 feet below the central, the static head is 27.00 city datum; at Terrace avenue, which is the lower city limits, the static head in a test well was 22.00 city datum, and at St. Mary's, which is three miles below the central station, the static head is 4.00 city datum. This shows a total drop of 28 feet in head within the five miles, which, to my mind, indicates a source of supply from the east, and possibly the river as that source.

The gravel in which the well points stop is very coarse, carrying some sand, but it is believed to be sufficiently open and porous to permit of a relatively high rate of flow.

The blanket of impervious clay not only prevents any possible contamination of the supply, but protects and maintains the pressure from below.

The limit of width of the water-bearing gravel is not well defined, as a sufficient number of wells has not been drilled to outline the limits on each side of the river, but during some recent tests at the central station, when the head in the wells was pulled down much below the normal level, some influence was felt at two wells, one located east of the river and the other west, being about 3,000 feet apart.

If this width of gravel should be maintained for the full length of the river within the city limits, with an average depth of gravel of 20 feet, a storage capacity for water is provided in this gravel bed of three thousand million gallons of water.

The first pumping plant put in and placed in operation in 1873 pumped river water, but it was later discovered that the station site was underlaid with this artesian supply of water, and by 1886 some 25 wells were drilled, using 4-inch and 6-inch pipe.

Some difficulty was had with water coming up between the clay and the pipe as the pipes were pushed through the clay stratum, but an outer casing was adopted, driven into the clay some fifteen or twenty feet, and the annular space was plugged.

The number of wells at the central station has been increased, so that now there are in use nine 4-inch wells, fourteen 6-inch wells, four 8-inch wells and six 10-inch wells. The wells vary in depth from 110 feet to 125 feet.

The supply being limited by the small ground area owned by the city at the central station, a new station site was obtained within the city limits and about 3,000 feet down stream from the old station, and a contract made in 1895 for the drilling of thirty wells 6 inches in diameter. These wells have an average depth of 85 feet and the screens project into the gravel about 12 feet.

The first three wells were located about seventy feet apart, and the water from the first well drilled flowed about eleven feet above the ground and some twenty feet above the river at a normal stage. A test was made at the time of the flow of the first five wells, the first three being seventy feet apart and the last two being 100 feet apart.

The test on each well with the others not flowing was as follows, as shown by a weir measurement, the rate of flow being for 24 hours and the

flow due to the natural hydrostatic head or pressure:

Well No. 1.....475,950 gallons per day
Well No. 2.....462,240 gallons per day
Well No. 3.....470,880 gallons per day
Well No. 4.....588,380 gallons per day
Well No. 5.....508,030 gallons per day

Another test of flow was made to determine the influence of the wells on each other, and the result of this test was as follows:

With gates closed on		Gallons per day
1, 2, 3, 4,	Well No. 5 flowed....	564,768
1, 2, 3,	Well No. 4 flowed....	588,380
1, 2,	Well No. 3 flowed....	392,250
1,	Well No. 2 flowed....	359,420
With gates all open	Well No. 1 flowed....	331,770

A loss on well No. 1 of 30 per cent. is noted when the adjacent wells are all open over what its flow was when they were all closed. The direct influence of the wells on each other of the 16 located within the reservoir within an area of about 3,600 square feet is very great, and the results of the tests show an exceedingly great dropping off of the average flow due to such influence.

During 1908, in order to test the condition of the wells at the central station, a small piston pump was attached to the individual wells and the pump speeded up until the vacuum gauge on the pump read up to about 25 inches, with the following results on the 16 wells lying within the reservoir at the central station:

Discharge from well	Gallons per day
No. 15—6-inch well.....	384,400
No. 16—6-inch well.....	406,000
No. 17—6-inch well.....	159,800
No. 18—4-inch well.....	95,000
No. 19—6-inch well.....	159,800
No. 20—6-inch well.....	126,700
No. 21—6-inch well.....	69,100
No. 22—8-inch well.....	112,300
No. 23—4-inch well.....	360,000
No. 24—6-inch well.....	273,600
No. 25—8-inch well.....	177,100
No. 26—6-inch well.....	234,700
No. 27—6-inch well.....	294,200
No. 28—6-inch well.....	318,800
No. 29—4-inch well.....	360,000
No. 30—6-inch well.....	384,000
	3,915,500
Adding for wells 31-36, outside	687,500
Makes total, wells tested...	4,603,000

The arrangement of suction mains is such at the central station that a two and one-half million gallon pump may be and usually is connected direct with these twenty wells, and at times it has been difficult to pull a vacuum of 22 inches on the large pump when so connected, so that the shrinkage is very great from the individual well tests to that when they are all pulled on, the variation extending perhaps from 4,600,000 gallons per day to 2,500,000 gallons per day, or nearly 46 per cent.

The results of the test showed three wells as non-producers, and one well had its valve closed, which when opened developed a good flow and a valuable well. After the cutting out of the three wells there was a marked decrease in the air in the suction main.

An interesting phase of the individual tests is shown by comparing well No. 1, which is a 4-inch well, which had presumably been in since 1886, and, pulling a vacuum of 22 inches, the piston pump threw 255 gallons per minute. Well No. 5, which is an 8-inch well and had been in the same time, under a 22-inch vacuum gave a discharge of 283 gallons per minute, while well No. 12, put in during 1906, with a vacuum of 23 inches, developed a discharge of 282 gallons per minute. Or with a variation for a 10-foot screen of a circumferential area of 10 feet for the 4-inch, 21 feet for the 8-inch and 26 feet for the 10-inch, the discharge ranged 255 gallons, 283 and 282, respectively.

There are certain advantages in the use of a ten-inch pipe, but there does not seem to be any direct ratio of increase of discharge from the use of different size pipes, the flow depending rather on the velocity in the gravel stratum of the water reaching the pipe.

No system of locating wells was used at the central station; it was merely a matter of putting a hole down somewhere and somehow, with the expectancy of having the water spurt up with a high pressure, and the effort was successful only because nature had provided a rich reservoir.

At the north station some thought was evidently given to the relationship of the wells, but an idea was advanced that the river had some direct influence on the flow, and some four wells were placed in the river and the most of the others parallel to and along the bank of the river, while the pump house was set some distance away, requiring long suction mains, and small pipes were used to too large an extent in connecting up the suction mains.

The wells were put down with an outer casing extending into the clay; the screens were about 12 feet long and the well pipe was extended up to the surface and capped, the lead to the suction main having a valve at each well.

With thirty 6-inch wells and four 10-inch wells a volume of water at the rate of 9,000,000 gallons per day has been pumped for short periods, but this reaches about the limit with the present layout.

The static head has not been materially reduced during the last fifteen years, and possibly none at all, as the head shown in 1895 was 11 feet above the surface of the ground at a point near the river, while the head measured a year ago was 9 feet above the surface measured at a well nearer the pump house.

The prospect of a continuance of a very efficient supply from this stratum of gravel is so good that the field will be further developed with new wells.

The real difficulty is the lack of reservoir capacity in the small wells to take care of emergency pumping, when all the pumps must be worked up to their capacity, and at such times the head runs off quite rapidly.

To provide against such a contingency, I have recommended the construction of a deep concrete reservoir, to be constructed near the pumps and to form a link in the suction line. The mains leading from and connected to the wells would be carried to the bottom of the reservoir at such a depth as to be entirely below the limit of suction of the pumps, and the intake pipe would draw from the same low level.

During a cessation of pumping, or when there is a normal load, the reservoir would stand full of water and provide a large storage; in the case mentioned a reservoir of one million gallons capacity was designed, and this volume would be ample to care for any sudden draught, as for fires or heavy pulls during the dry season for sprinkling.

The water has, of course, a fairly uniform temperature, and, being free from any source of contamination, the most strict requirements are met as a potable water for domestic use, and it is also very satisfactory for commercial uses, as shown by the following recent analysis, parts in 100,000:

Odor	None
Color	0.0
Turbidity	None
Sediment	None
Free ammonia	.0914
Albuminoid ammonia	.0054
Nitrates	None
Nitrites	.0002
Chlorine	1.4
Total solids	36.6
Fixed solids	29.8
Hardness	24.6
Iron	.001
Colon bacilli	Absent
Lead	None

WATER SUPPLY AND TREATMENT FOR POWER PLANT PURPOSES.*

By William Miller Booth.

THE price of raw material, of fuel, labor conditions and freight rates are important factors to be considered when a new industrial plant is to be built. Less often investigated, yet of primary importance is the presence of a constant supply of good water. If possible two independent sources should be made available.

It is not a large manufacturing concern that requires boilers of 1,000 h.p. capacity. If run 10 hours per day these evaporate approximately 170 tons of water. When condensing engines or turbines are used, from 14 to 17 times as much water is necessary to return the steam again to its original state, or about 2,500 additional tons—in the aggregate more than 9,000 pounds per minute.

The quality of the water is not a matter of indifference, as modern power house apparatus makes exacting demands of the medium passing through and over its parts. It will readily be seen that choice of water requires knowledge of power plant conditions and should not be handled in a haphazard way.

While our population and manufacturing interests constantly increase, available water is decreasing, especially in our small streams that flow through densely settled districts.

Given two sources, the use of that which entails the least cost is nat-

*From a paper before American Waterworks Association.

urally considered—the quality is often neglected. Unfortunately water exactly adapted to boiler use is seldom found in nature.

With a general idea of the strata of a locality a practical geologist can predict with considerable accuracy the quality of water to be found on the surface and in wells.

For convenience we classify waters as follows:

Soft Water:				
From Rain and Snow	Contain:	Ammonia salts	Action:	Corrosive
Granite and quartz rock		Alkali		Negative
Returned		Ammonia		Corrode
Swamps		Organic matter		Corrode
Lakes and large rivers		Calcium and magnesium salts		Slight scale
Hard Water:				
From Springs	Contain:	Lime, magnesia, iron	Action:	Scale forming
Lakes		Sulphates		
Small rivers and creeks		Chlorides		
Wells		Carbonates		
Saline Water:				
From Sea	Contain:	Lime, magnesia	Action:	Scale forming
Wells and mineral springs		Sulphates, chlorides and carbonates of sodium and potassium		Corrosive Foam
Alkaline Water:				
From Streams from Western plains	Contain:	Sodium chlorides, sulphates & carbonates, silica, lime, magnesia	Action:	Foam
Springs				
Acid Water:				
From Mineral springs and wells	Contain:	Hydrogen, sulphide	Action:	Corrode
Coal regions		Iron sulphate and sulphuric acid		

The first group includes rain and snow waters that are free from scale-forming materials, but which contain organic matter and in the first instance may have a strong acid reaction. The use of such waters is attended with danger from pitting. Harder water should always be mixed with these, or a slight excess of alkali may be added.

Precipitated waters flowing over granitic rocks are ideal for boiler use, as enough alkali is absorbed to prevent pitting. Water from wells in the Adirondacks, driven in granite and quartz sand to a depth of sixty feet, was found to possess a hardness varying from .5 to 2 degrees Clark—pure water being unity.

The only distilled water practicable for boiler purposes is that returned from vacuum pans, pumps, engines, turbines, surface condensers and heating systems. Condensed water from turbines containing no oil ought to be ideal for boiler use. We have, however, had an instance of severe corrosion resulting from the use of such water with a proportion of fresh hard water added at each return to the boilers. Returned turbine water should be made slightly alkaline. We believe that the open heater and hot well should be much more generally used and that a good oil separator is indispensable in any large plant. Anxious to keep his apparatus well lubricated the engineer often uses an excess of oil which makes it difficult to utilize the condensed water. A large amount of energy escapes daily from many plants through heated water that runs to waste, in addition to the loss of soft, scale-free boiler water. Many engineers suffer from oil at the surface of the water in the boiler; the gauge glass showing this condition quickly. If mineral oil is used in the power plant we do not worry about the presence of a small quantity in the boiler, but prefer to keep it out.

Another class of soft waters is found in the lowlands of the coast. A heavy rainfall with finely divided organic matter and heat, combine to charge standing water with organic matter which may be acid in character. Boilers using such water suffer from corrosion and require alkali.

The waters of some lakes, large rivers and a few deep wells deposit little scale and may be termed "soft." Arbitrarily we fix the hardness under 3 degrees Clark. Such waters contain suspended particles, sand, clay, leaves and dissolved organic matter, the quantity of these varying greatly during different seasons. These require considerable blowing down at the boiler. Water of this character is improved by sedimentation in large tanks followed by upward filtration through coarse material, as sand, coke breeze or excelsior.

We insist that water for boiler purposes shall be clean. Sewage laden lake or river water carries grease which accumulates upon the headers of water tube boilers and corrodes the tubes and sheils of tubular boilers. Our clients are much annoyed by such water. We recommend sedimentation, upward filtration and legal proceedings against the corporation or individual contaminating the stream. This applies particularly to abattoirs, rendering plants, woolen mills and cities. As a last resort we recommend chemical precipitation and filtration.

HARD WATERS.

A large proportion of our water supply is scale forming. If ten grains of this material per gallon are present nearly 140 pounds of sludge and scale will concentrate, in a 24-hour, 1,000 h.p. plant. This badly interferes with the operation of the boiler as a steam producer. In many samples of water, carbonates vary from 3 to 15 grains per gallon and sulphates from a trace to 120 grains per gallon. What these compounds are and how they are formed will not be discussed here.

Organically pure but hard sources of supply are used by many cities and towns to the disadvantage of manufacturers. We have suggested in a previous paper that large operators should combine to manufacture soft water for their common use. Water companies might soften supplies furnished certain districts. We believe that scale-free, clean water is worth ten cents per 1,000 gallons. It usually costs less than three cents to soften this.

Many manufacturers drill deep wells to provide drinking water and to serve as an auxiliary supply. We suggest consultation with a practical geologist before putting a large amount of money into such an enterprise.

Having been fortunate enough to obtain water this may be of any class mentioned in the table. For power plant purposes heavily charged mineral waters are to be avoided. We present an analysis of a well water that is useless for boiler purposes:

Grains per U. S. Gallon. Combined.

Sodium chloride	1.252
Calcium carbonate	16.959
Calcium sulphate	87.462
Magnesium carbonate	.000
Magnesium sulphate	15.555
Magnesium chloride	.000

Calcium and magnesium carbonates and calcium sulphate are scale producers. Chloride of magnesium corrodes metal and sodium chloride accumulates on all semi-heated surfaces. For boiler purposes we have not been troubled by the precipitation of iron found in natural waters. If water from a well contains all of these forms of impurity in any considerable quantity it should not be used for power purposes. Those who drill wells should take samples of the strata and water encountered. Analysis of these will show what veins of the supply are to be avoided and cased out. As an example of the vicissitudes of well-drilling we instance the following:

To 100 ft.—small quantity, soft water.
100 to 600 ft. no water.
At 600 ft. salt; 300 grains per gallon, sodium, magnesium and calcium chlorides, with carbonates and sulphates.
At 900 ft. salt.
900 to 1,200 ft. no water.
1,270 ft. granite rock, no water; drilling suspended.

SALINE WATERS.

Few waters are free from chlorides. Common salt is not considered scale forming, although large quantities are not easily handled, while the chlorides of calcium and magnesium are very objectionable in a boiler. We have found no trace of chlorine in an Adirondack camp supply drawn from a small stream. Water from Oneida Lake, N. Y., did not contain one part of chlorine per million. This lake is 28 miles long and several miles broad. The sample was taken through the ice in the winter.

Wells, springs and streams in the Salina group contain chlorides varying in our experience from traces to 600 grains of salt per gallon. The quantity of chlorine at various localities in central New York westward is as follows:

Canajoharie, 570 ft. under surface	6 grains
Utica, 600 ft. under surface	300 grains
Oneida, 100 ft. under surface	30 grains
Syracuse, 50 ft. under surface	360 grains
Cayuga Lake	2 grains
Seneca Lake	2 grains
Akron, Ohio, 60 ft. under surface	2 grains

Waters in this belt contain also sulphates and carbonates of calcium, magnesium and sodium, the water varying in hardness from 5 degrees to 80 degrees Clark. Such water is found in

Ohio, Ontario, Indiana and Michigan. These ground waters generally need treatment. Shale waters if in higher altitudes are very good with an average hardness of 6 degrees Clark.

We have no remedy to offer for heavily charged saline waters. Evaporation results in choking boilers and condensers. Wells on opposite sides of New York Central tracks at Oneida, N. Y., about 150 feet apart contain respectively 9 and 30 grains of salt per gallon, the first being 96 feet, the second 106 feet in depth. Both waters are used successfully, the first without, the second with softening apparatus. Well water containing one and one-half ounces of salt per gallon and scale forming cannot be used by Syracuse manufacturers to good advantage.

ALKALINE WATERS.

Some waters contain carbonate, chloride and sulphate of soda and potash with perhaps chlorides of calcium and magnesium.

This is particularly true of waters of the western plains and lakes. As an extreme instance we submit the following analysis of a water sent us from a California lake:

Grains per U. S. Gallon.

Silica	14.35
Alumina	trace
Oxide of iron	.00
Calcium carbonate	trace
Magnesium carbonate	.00
Potassium chloride	93.56
Sodium chloride	2754.30
Sodium sulphate	610.50
Sodium carbonate	2573.10
Acid carbonate of soda	248.50

This is a representative of a very bad sample of alkali water, which could not be used for technical purposes.

Our practical experience with alkaline waters has been confined to those artificially produced in Eastern plants by the softening process. If a boiler is clean we find it almost impossible by adding alkali to produce foaming. This has been proved with an excess of soda ash amounting to 50 grains per gallon.

ACID WATERS.

Water from expensive wells sometimes tastes and smells of hydrogen sulphide. If at all strong, engineers will usually not allow such water in their boilers. We believe that, should circumstances warrant the outlay, a heavily charged sulphur water could be successfully prepared for boiler or other industrial use.

Water from the mining districts often contains sulphate of iron. We consider this dangerous water and suggest treatment before use.

Some waters contain free sulphuric acid. Sometimes such water is supplied naturally but generally this is found in sludge from acid plants, coal washers, or refineries. No more dangerous material can find its way into the boiler.

A sample of scale from boilers in a Pennsylvania steel works was practically pure oxide of iron, the result of an acid supply.

We devote the remainder of this article to methods of handling scale-forming, saline, and alkaline waters.

Three principal uses of boilers afford a natural division as follows: marine, locomotive, stationary.

Marine boilers are generally supplied on coast-wise steamers, tugs and harbor craft, with soft water that is obtained at one of the ports at which the vessel touches. As many of the engine cylinders are run without oil the returned water is used again. Trans-Atlantic steam ships are supplied with surface condensers and complete distilling outfits of expensive design and the softened water is used again.

Locomotive boilers represent an enormous horse power and need the best water obtainable. Hard water only can be found on many lines. Sometimes a soft supply is found at one end of a division and hard water at the other. Alternate use keeps the boiler free from scale. Starting and stopping and generally in motion, the alkaline content of a locomotive boiler water must be kept low. With sludge, serious foaming may result through the use of an excess of softening agent. This subject demands immediate attention on the part of all railroads. Western systems have done more in this respect than those in the East.

Our experience with stationary boilers has been divided between shell and water tube types. Methods of water treatment apply in a general way to either, although many disadvantages of hard and muddy water are overcome in water tube boilers.

Engineers in charge of steam plants are usually ignorant of the principles of water purification. This is only partially their fault, as literature for their education has only recently been available. There are many plants the boilers of which cannot be operated a single week without a deposit of scale serious in character and quantity. The most easily procured remedy has been the "compound" furnished at an in-

flated cost. The introduction of the softening plant has widely advertised the fact that lime, soda ash, caustic soda and tri-sodium phosphate are cheap and efficient scale removers. Many an engineer spends the Sabbath day hammering scale only to repeat the operation the Sunday following. This is usually unnecessary, as proper chemical treatment will remove the scale formed and prevent the deposit of more.

The actual cost during the past seven months to keep boilers clean in a 2,000-h.p., 24-hour plant has been less than $15, the hardness of the water being 5 degrees Clark. Caustic soda and soda ash have been used in excess about 2 grains per gallon.

Ideal conditions favor the installation of a standard softening system. We feel, however, that prejudice is so great that it will take at least five years to make these plants popular with engineers who have in many instances received gratituities from compound salesmen, or with managers who cannot see an adequate return for the investment.

We now turn to methods of treatment.

While waiting for a better understanding of the correct thing to do when annoyed by hard water we have adopted the following method which is now used in many plants. Analysis is made of the water supply or supplies; of the water from the heater, from each boiler and from the hot well. In this way we find remarkable conditions. The hardest water that has come to our notice was taken from three water tube boilers: 1. 43 degrees Clark. 2. 85 degrees Clark. 3. 382 degrees Clark.

It is not unusual to find alkalies and scale-forming ingredients concentrated in the boiler water. If the supply has a hardness of 10 degrees Clark, the internal water may have a hardness of twenty, thirty or even forty degrees.

Great stress has been laid on the removal of carbonates by heaters. We find carbonates in most boiler waters and believe that the best heaters may remove 50 to 75 per cent of these. The water circulates too rapidly to favor their deposit and the dissolved gases are occluded under pressure. The concentration of chemical salts in the presence of organic matter may cause serious corrosion. We believe that sulphates of calcium and magnesium may produce or aid in producing the holes that are eaten in feed pipes and flues, heretofore credited to chloride of magnesium, but which we find may occur when none of this chemical is present. Further investigation must be made to determine the exact cause of the foregoing results.

Having proved the presence of concentrated salts in a set of boilers, we suggest to the engineer that he shall "blow down" once in four hours or two or three times per day from one-half to two inches of water. This form of treatment some engineers will not adopt, stating that it will strain their boilers to blow them under full steam pressure; others do this regularly. We have a plant of this kind in mind where there are two 200-h.p. shell boilers that have been blown down under full head of steam perhaps two inches each afternoon for four years with no injurious results.

The scale-forming materials separate in the boiler, the decomposing carbonates rising to the top and forming a light scum, which accumulates on the upper tubes, while the sulphates and precipitating carbonates form a dense, heavy scale on the shell and lower tubes of the boiler. We believe that it is a very good plan to blow out the accumulated sediment in the morning and in the evening, and that considerable scale may be removed from the water surface while the boiler is under full steam pressure, by opening suitable cocks.

Boilers are set in peculiar ways either accidentally or through ignorance. We have found boilers with the blow-off at the rear no less than 4 inches higher than the floor of the boiler at the front. In some boilers the blow-off is found 3 or 4 inches above the lowest point of the shell, and we find engineers who blow their boilers but once per week, putting in from one to five gallons of compound Monday morning, and making this last the entire week, blowing it out at the close of the working day Saturday. Severe scaling or severe corrosion may result from the lack of use of the blow-off valves. If we were running a boiler or a battery of boilers using hard water we would use the blow-off at least three times during the 24 hours. Lack of attention regarding falling scale and accumulating sludge may result in a bad bag or blister of the crown sheet.

If the engineer finds that he cannot handle the sludge through the blow-off valve, (and this the chemist can determine usually in advance), a mixture of alkali should be used in the boiler. This is added with the feed water drop by drop. The quantity bears

but little relation to that prescribed for the same water in a water softening outfit. For instance, the prescription may call for five pounds of soda ash and two pounds of caustic soda per thousand gallons of raw water. If this is placed in the boiler in exact proportion to the number of thousand gallons used the chances are that very severe foaming will result during the coming three days. We prefer to divide the prescription by at least five and then set samples of water taken from the boilers under treatment, making a careful analysis of such treated water. In this way we are able to determine the quantity and amount of chemicals absorbed and those left in solution, also the quantity and amount of scaling material removed, and that left in the water.

The scale that accumulates on the tubes and shell is often useful in determining the kind of treatment that a boiler needs, but this scale may differ materially in composition at different points in the boiler.

The use of boiler compounds containing tannin is determined by black scale, which is a dye formed by the union of tannin and iron at the expense of the boiler itself. We discourage the use of such compounds.

Objections are raised by some engineers to the use of soda ash in boilers. We have yet to find a single instance where soda ash, if used in moderate quantities, even to 50 grains per gallon in excess, has injured a boiler shell or tubes, and would much prefer the use of a small quantity of this material in a boiler water to the use of rain or distilled water, both of which have a highly corrosive effect on iron. Again, some engineers state that soda ash injures gaskets.

During two seasons we have tried this out in a 2,000-h.p. plant where the steam is used for heating houses and office buildings, and although expensive and complicated steam traps, meters, and gaskets are used throughout the system, we have failed to experience any difficulty whatever from this method of treatment.

Having reckoned the amount of caustic lime required to remove carbonates from water for internal treatment, we use a fraction of its equivalent of caustic soda. With carbonic acid this material is changed to sodium carbonate and if sulphates are present a second reaction takes place. A much smaller proportion of soda ash is required than when lime and soda ash are used.

On account of this double action, we believe that caustic soda should be used much more generally in water, as it is more easily handled than lime and as, further, a concentrated solution can be made. After the preparation has been applied and an analysis of the water has been made, it is not difficult to see what changes are necessary. These should be applied at once. Any form of exact treatment for boiler water within or without the boiler, demands the services of an experienced chemist and an interested engineer. An excellent water softening apparatus failed because the engineer in charge would not give it fair treatment.

Those in charge of power plants are usually anxious to learn some of the principles involved in water purification. It has been our practice to supply a regular outfit for their use. This includes the following:

1 glass burette, funnel and filter papers.
1 bottle phenolphthalein solution.
1 bottle methyl orange solution.
1 bottle silver nitrate solution.
1 quart of soap solution with the formula for making up more, and sometimes a bottle of standard decinormal hydro-chloric acid. This apparatus is purchased by the power plant owner, and placed in the engine room. We have been told by one engineer that he would not take one hundred dollars for the little kit of tools provided to determine the processes going on in the boiler water. The number of tests that these men will make and the care and accuracy exercised in making them are surprising. We have gotten up a printed form for permanent records, such being turned in at the office each day.

WATER-SOFTENING PLANTS.

As there are now several forms of water softening apparatus on the market that are entirely efficient the power plant manager and operator have no excuse for using a scale-charged water. With a thousand horse-power or a larger plant and with water about 10 degrees in hardness a water softening outfit can be shown to be an investment paying more than 10 per cent. on its cost and operating expenses. In some instances this percentage may be raised to a point where the whole apparatus will pay for itself within two or three years. There is great prejudice on the part of engineers to the use of softened water, and we have found men who have put in expensive plants of this sort who are not operating them. The reason being that "they're too much bother."

Considering the cost of extra fuel, flues, the cost of opening the boilers, removing scale and poor steaming capacity a scale-free water is a valuable investment. We find plants that are operating with boilers that have not been opened for months, and that are found in a scale-free condition, the water being of a hardness of about 20 degrees Clark per U. S. gallon. Originally we were not sure of the action of caustic lime and soda ash on concrete tanks, but believe that with a carefully constructed tank of this kind no danger whatever will result through the action of the alkali on the cement mass. A tank has been in use for this purpose for three years and is still in first-class condition.

The ideal chemical for softening water is not now available. Calcium, magnesium and the sulphate radical should be removed. Excessive foaming would be avoided and softened water would approximate distilled water in purity.

SUMMARY.

In conclusion we wish to call attention to the following:

To locate at least one constant supply of good boiler water is an important duty of the engineer who lays out a new plant—if more than one supply can be made available every reasonable effort should be made to secure the second.

Water for boiler purposes should be clean and scale-free. Filtration and softening will produce both conditions even though the supply is bad, chloride and alkaline waters excepted.

Money put into a "well" enterprise is a business venture with uncertain results, but is recommended if conditions warrant the expense.

Water companies should give technical aid to large power users if difficulty is experienced with the water furnished; that delivered to manufacturing districts might be softened before distribution.

Resident engineers should be compelled to make daily reports of the condition of the water from their boilers and a competent chemist should be employed in connection with every large power plant.

This association could to good advantage appoint a committee to report on technical methods of water analysis with the official adoption of a provisional method to be used throughout the United States. This branch of practical chemistry is now of great importance to mechanical engineers.

THE TUNGSTEN LAMP AND ITS RELATIONS TO CENTRAL STATIONS.

By George Merrill.

THE object of the following article is to show the effect of the tungsten lamp and its later developments upon commercial interests. As lamp manufacturers, we are as vitally interested in the commercial success of the tungsten lamp upon central station circuits as are the central stations themselves. The tremendous success with which this lamp has so far met is most gratifying to us, and the rapidity with which central stations have adopted it has even exceeded our expectations. We realized, of course, that the lamp would have to prove its cause, which it has very ably done, and, further, that until its merits were thoroughly demonstrated in actual service, the central stations would be very conservative in regard to its use upon their circuits.

At the Atlantic City meeting of the National Electric Light Association last June, two papers, one dealing with the effect of the tungsten lamp on revenues, and the other a report submitted by the lamp committee, recommended to central stations a broad tungsten policy as productive of the best results. Companies were urged to overcome their fear of decreased revenue in connection with the new lamps, as in practically every case it was found that the revenue could be maintained by the new business available as a result of placing the tungsten lamp freely before the consumer. Moreover, a consideration of the ultimate benefits which are sure to follow such a plan should be enough to overcome any fears for the present.

The two papers referred to, the one based largely upon replies to forty questions submitted to a large number of companies throughout the United States and Canada, and the other based on the judgment of several prominent men of the association, who have taken a broad view of the

present situation, spoke with such favor of the new lamp that we cannot but believe that the central station must find it valuable. This conclusion is further warranted by the experiences of a number of companies from various parts of the country as brought out in the several discussions at the same meeting.

In the earliest conception the central station and incandescent lamp industries were most intimately connected. The first commercial methods of generating electrical energy, of subsequently distributing such energy, and of ultimately transforming it into light, were perfected by Thos. Edison some thirty years ago. After years of patient effort he succeeded in making an electric incandescent lamp which was of low efficiency and which had a life of but a few hundred hours.

In the incandescent lamp, by means of which electrical energy is converted into light, greater improvements have been made than in any other single piece of apparatus which is used in the process of producing such light. Not only has the electrical efficiency of light production been increased about 500 per cent., through the incandescent lamp, over its first commercial form, but the life of the lamps to-day at 1.25 watts per candlepower is many times greater than the early lamps even at an efficiency as low as 6 watts per candle. As the lamp manufacturing processes became better understood, the efficiency at which it became possible to operate the carbon lamp, and still secure a commercial life, was gradually increased so that we had the successive steps from the very low efficiency of the early lamps up to an efficiency of 3.1 watts per candle power which for a good many years has been the highest standard efficiency for carbon lamps. Until but a few years ago the possibility of ever securing an incandescent lamp with an efficiency much higher than that of the standard 3.1 watts per candle power carbon type seemed rather remote, and it is no wonder that the relation between the electrical energy consumed and the quantity of light produced by this lamp should have been used as a convenient basis by some central stations upon which to establish their system of lighting rates. That such an important question should have involved the efficiency of the lamps by which the light was produced, appears rather unfortunate, when we consider that within only the last few years it has been made possible to produce a certain amount of light with practically one-third of the energy formerly required.

In central station work the fixed operating and investment expenses form such a large proportion of the total cost of operation that it is very essential to take such charges correctly into consideration in laying out a profitable and equitable system of rates. In some cases the fixed charges which were to cover the fixed expenses were calculated on the basis of a certain number of hours' use of the connected load, usually in the familiar "16 candle power 50 watt equivalent," and were then included in some way in a kilowatt hour rate and thus made dependent on the amount of energy consumed.

It thus happened that in some cases central stations were operating on a system of rates which did not appear well adapted to a change to a higher efficiency lamp. The reduction in the amount of energy required to produce a certain quantity of light by the perfection of new light sources, naturally disturbed those central stations whose rate systems were largely based on the use of carbon lamps, and were it not for the fact that the new lamps served to stimulate a desire for more light on the part of the consumers, and further that it has been possible to secure business with the tungsten lamp which would not have been available with a less efficient and less attractive source of light, the situation would have been far from pleasant for many central stations. The same general state of affairs existed in the gas industry at the time of the introduction of the Welsbach mantle. The gas companies at first looked with considerable disfavor upon the newcomer through fear that the straight meter rate so largely used in the sale of gas would result in a serious loss of revenue. Experience soon demonstrated, without a question of a doubt, that the advent of the high efficiency Welsbach lamp was a wonderful stimulant to the gas business, and that the creation of a new business department and the active work along the lines of heating and cooking devices which came with increased activity in the lighting end of the business, served to bring about a very prosperous condition. We may confidently expect a similar prosperity in the central station industry as a result of the increased interest and activity awakened by the tungsten lamp. Public interest is now aroused in the question of lights and lighting as never be-

fore. A consumer who can, when daylight fails, flood his residence or store with a clear white light, that even rivals in beauty the daylight which it has been called upon to replace, derives a certain sense of satisfaction from his electrical service that he had never before felt. He appreciates the fact that light is a very valuable thing, and that good light, and plenty of it, will accomplish wonders in making his home more inviting or his store more attractive.

The high efficiency of the tungsten lamp makes it possible to secure in all classes of service, whether residential or commercial, a degree of illumination which, a few years ago, would have been almost beyond question because of the excessive cost, and which could not have been rivaled in purity of color at any price.

The residential lighting field can be profitably invaded with tungstens if the campaign is properly carried out. As a general rule, people are usually willing to spend about so much for electrical service, and through a reduction in the cost of electric lighting by the use of more efficient lamps, electrical heating and cooking devices of all kinds are offered an excellent opening. The effect of such a residential campaign should eventually tend to cut from the peak of the station load curve and fill in the hollow which has so long troubled the central station men.

A residential consumer who installs tungsten lamps, thus reducing his maximum demand, and who, by the use of any of the very handy electrical devices, consumes practically the same number of kw. h. as before with a lighting load only, betters his individual load factor, and enables the central station to serve with a given kw. of installed capacity a larger connected load. Such results cannot be secured in a day, but must come with a gradual education of the consumer to the advantages of electrical service for other purposes than for lighting alone, and with such realization on the part of the consumer will come increased prosperity for the central station.

The effect of installing the tungsten lamps on commercial circuits has been proven to be very successful and has raised but little doubt as to effect on revenue. Commercial customers are usually willing to take considerably more light than they had previously been using as they realize that the advertising value of such illumination makes it well worth the cost. I am sure that many merchants obtain more benefit from the attractive appearance of their store and show windows than from almost any other form of advertising, and further, that a proper lighting installation can do more toward producing such a desired effect than any other one thing.

To see that the new lamps are installed in the best possible manner should be the aim of every progressive central station. It is not only unjust to the consumer, but it is poor policy on the part of the station to allow tungsten installations to be made without at least telling the consumer something as to the best manner of using the lamps.

We may touch very briefly on the general progress in the art of lamp manufacture. The carbon filament lamps of 3.1, 3.5 and 4 watts per candle have been improved gradually from their early forms by constant research and development work, and even within the last few years a great deal has been done in bringing all types and sizes to a uniform high quality by more rigid inspections, careful photometry, and close selection. The gem lamp, the first step toward high efficiency, with a cellulose filament, metallized by the heat of the electric furnace, made it possible to burn them at an efficiency of 2.5 watts per candle with a life comparable to that of the carbon lamp at 3.1. A little later the tantalum lamp, with a metallic filament, was produced and was able to give a good commercial life at 2.00 watts per candle. This lamp did not receive the attention from the general public that it might have because the announcement of a lamp of even still higher efficiency was made before the tantalum lamp had been really commercially introduced.

The tungsten lamp is the result of years of research in the realm of new materials suitable for incandescent filaments. Great difficulties have been overcome, but the work will not stop, and the next year will witness a gradual improvement in the quality of the tungsten lamps, which to-day are giving such good results, just as the carbon filament lamps became better as experience was gained in the details of their production.

The tungsten lamp has been commercially developed for practically all classes of service, ordinary multiple, street series, sign lighting, train lighting, automobile lighting, miniatures for flash lights, surgical use, and for general decorative effects.

A 150 watt 120 candle power tungsten lamp has recently been added to the standard multiple line and fills the rather wide gap which previously existed between the 100 and 250 watt sizes. This lamp is placed on the market with the belief that it will, in many cases, prove very valuable in changing from gas to electric installations. The tungsten lamp for 200 volt service can soon be obtained in wattages of 15, 70, 110 and 180. These lamps should prove most valuable where 200 to 250 volt service is installed, as it will be the first high efficiency lamp produced for high voltage work.

The tungsten street series lamp can be obtained in candlepowers from 25 to 80 and in ampere ranges of 1.75, 3.5, 4.0, 5.5, 6.6 and 7.5, which meet the requirements of most practical work. The lamps can be operated in series with either incandescents or arcs, provided that the current of the circuit can be maintained at the value for which lamps were ordered. The tungsten street series lamp has several advantages over any other type of illuminant for the majority of streets. They can be installed on either the curb line or over the center of the street. They can be obtained in such candlepowers as will permit the most desirable spacing, and they can consequently be placed low enough to miss the obstruction of dense foliage, which often interferes with and in many cases altogether destroys the illuminating value of an arc lamp hung high over street intersections.

The tungsten street series lamp possesses advantages over gas for street lighting, in that it is capable of more varied and artistic arrangement; that is has a smaller depreciation in candlepower from the initial value, that the constancy and quality of the light is better and in the ease with which it can be controlled from some central point.

The tungsten street series lamp is rugged. Its comparatively heavy filament suffers but very little chance of mechanical breakage. It is capable of showing considerable economy over the carbon or gem types now in use, and from reports of many installations there is no question as to its merit in this respect. The tungsten street series lamp is well worth investigating, as increased candlepower in tungsten street lighting units for the same amount of money that the older types brought, appeals strongly to a city council and has a good effect on the general public, as far as its attitude toward the central station is concerned.

The central station man may feel absolutely confident in offering the tungsten lamp freely and without hesitation to his consumers that he is placing at their service the best means of converting electrical energy into useful light, and that a broad policy together with an interest in seeing that the lamps are installed in the best manner, cannot but in the end prove to be of the greatest benefit, not only to the consumers but to himself as well. The relations between the central station, the lamp manufacturer, and the consumer are very close. The central station supplies the energy for producing light; the lamp manufacturer supplies the means by which the transformation is accomplished. Only by co-operation between the two can the industries which they represent reach the fullest and broadest development.

CENTRAL STATIONS FOR TOWNS OF 1,000 POPULATION.

By Caryl D. Haskins, Manager of Lighting Department General Electric Company, Schenectady, N. Y.

WHEN the electrical industry was comparatively young, the greatest interest was displayed in the establishment of new plants to supply electricity for illuminating purposes, and the activity along these lines was so great at that time that installations were made in almost all communities of sufficient size to warrant the outlay.

Since that time, the electrical art has progressed with almost marvelous rapidity, and communities in which plants were established, many of which were at that time comparatively small, have also grown from the rank of towns to that of cities.

The result has been that gigantic installations which have grown up in the last few years have monopolized the greater portion of the talent and the time of those men who have made a specialty of electrical development; and the installation of new plants in

comparatively small or medium size communities has not received the attention from the engineering fraternity that it did in the past.

During this period a new generation has grown up, and to-day there are a vast number of communities in the country which are of sufficient size to support an electrical lighting plant, and which are in a position to demand the best that the world has to offer in the line of artificial illumination.

While it is true that the interest of our greatest electrical men has been diverted from channels of new development to the problems incident to larger installations, the interest through the country at large has been greatly increased. This is evidenced each day by the large number of inquiries which are received, asking for information as to the cost of installations and operations of electrical plants for towns ranging in population upwards from 500 people.

It is the purpose of this article to answer some of these general questions and to provide preliminary facts and figures on the costs of such installations.

Owing to the marked increase in efficiency, sturdiness and simplicity in the design of electrical apparatus, together with an even more marked decrease in first cost, towns which ten years ago could not have supported electrical plants, may now advantageously consider installations.

In making an estimate of the costs and apparatus necessary to install an electric power plant in a town of 1,000 people, there are many factors which must be predetermined in order to obtain figures which will exactly apply to any set of local conditions.

The best that can be done in making up a general proposition is to presuppose certain factors, derived from averages in a large number of particular cases. In making such general figures applicable to any one definite locality, the greatest care should be exercised in determining the exact value of these factors under such local conditions.

Probably the two most important items for determination are: The length of service which the plant shall supply, and the kind of fuel which will give the cheapest and most satisfactory results. It has, therefore, been thought expedient to make our general figures on plants operating for both power and lighting; that is, 24 hours a day; for plants doing a lighting business alone, running from sundown to morning, with possibly certain morning hours of service in the winter, the average operation being about six hours a day, and for each of these plants two types of fuel have been considered, coal and natural gas.

The uses of electricity are increasing so rapidly at the present time that almost every day brings to light some new application, and for this reason every new company should carefully consider the possibilities of service for power purposes; and if this cannot be profitably carried on under the present condition, provision should be made for maintaining a 24-hour service sometime in the very near future.

It is perfectly obvious that power business can be taken on at much lower rates than ordinary commercial lighting business, as the hours of service are much longer and the peak load very much less pronounced. Moreover the same machinery which is used in a strictly lighting plant only six hours a day may be operated 24 hours; thus getting four times the amount of work from the same invested capital.

Before proceeding with the detail estimates it might be well to state that the freight item, on account of its large variation, has not been included, and it has also been assumed that water may be obtained without cost. Further, it has been necessary to make arbitrary assumptions, based on average conditions, on the cost of fuel, poles, land, etc. The figures are throughout conservative and in all cases a ten per cent. item has been added to cover extras.

24-HOUR PLANT.

While it is by no means a common condition, there are many towns of 1,000 to 1,200 people, which have industries of sufficient size to support 24-hour service, and if in such a locality the connected load of 80 horsepower can be obtained in motors, it will most certainly pay to install a plant for this service.

In making an estimate the first problem that presents itself is the determination of the capacity of the plant. This is done in the following manner:

The connected lighting load for a plant operating 24 hours a day in a town of 1,000 or 1,200, usually consists of about:

1,500—16 c. p. multiple incandescent lamps, equal to 60 kw.	80.5 h. p.
60—60 watt series incandescent lamps equal to 3.60 kw.	4.83 h. p.
5—arc lamps equal to 2.5 kw.	3.85 h. p.

In addition to this, we should expect a connected load of not less than 80 horsepower in motors.

1. The day or motor load will slightly overlap the night load; this must therefore be considered in figuring size of installation.

Fifty per cent. of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to daylight, therefore, the total load on the station would not exceed 50 per cent. of the connected incandescent load (60 kw.) or 30 kw. plus 6.1 kw. (8.18 h. p.) the arc load necessary for street lighting, or 36.1 kw. (48.1 h. p.) which figures do not include line loss.

A plant of 100 kw. (134 h. p.) capacity will be of ample size to furnish this amount of energy, including all loss incident to the transmission, for the peak caused by the overlapping of day and night loads and allows for spare apparatus to cover emergency conditions.

The total cost of a building for such an installation, including the foundation and real estate, should not be more than $1,650.

LIST OF APPARATUS IN GENERATING STATION.

Boiler Room—	
2—70 h.p. return tube boilers at $725	$ 1,450.00
Masonry	550.00
Piping, inc. connection to engine	250.00
Foundation for heater and pump	25.00
Haulage	75.00
1—Steel stack, 100 h. p.	135.00
1—Feed water heater, 100 h. p.	150.00
1—Boiler feed pump, 100 h.p.	110.00
Total	$ 2,775.00
Engine Room—	
2—75 h. p. high speed simple engines, $1,050 each	$ 2,100.00
Foundations, each $100	200.00
Installation, each $100	200.00
2—50 kw. (67 h. p.) generators, $805 each	1,610.00
2—Belts, $50 each	100.00
Switchboard	500.00
2—2½ kw. CQ exciters, $150 each	300.00
2—Belts, $10 each	20.00
1—C. C. transformer	220.00
1—2 kw. transformer for station lighting	30.00
Installation, wiring, foundation, etc.	220.00
Total	$ 5,550.00
Franchise and legal expenses	350.00
Building, including real estate	1,650.00
Total cost of station	$10,275.00

These figures are conservative, and it is probable that by careful supervision the cost of the plant could be considerably reduced.

After generating the current at the station it is necessary to carry it to the consumers. The method of carrying it, or transmission as it is commonly called, depends upon the size of the town. If the station can be located in the most thickly populated portion, that is, at the center of distribution, and if 75 per cent. of the load is within 1,250 feet of the station, the current may be at low voltage; i e., 220 volts.

There are many advantages to this system in that it obviates the use of transformers and brings the current through the streets at the same pressure as is used in the houses.

On the other hand, unless the load is distributed as outlined above, the cost of a low voltage installation is out of all proportion to its advantages, and in this case it is expedient to use a pressure of 2,300 volts and transformers to reduce the voltage. The problem of distribution is one which must be solved for each individual case, and when making a definite estimate of the cost of a plant, it is recomended that a map of a town be furnished (or if this is not available, a sketch) showing the streets, the probable location of the power plant, and where the current will be used, and send it to the manufacturer. With this information they will gladly give a recommendation which will exactly meet the requirements.

The cost of a typical distribution using 2,300 volt, three-phase with transformers is:

10—5 kw. (6.7 h. p.) pole H. B. type transformers	$ 500.00	
5—2 kw. (2.68 h. p.) pole H. B. type transformers	145.00	
4—1 kw. (1.34 h. p.) pole H. B. type transformers	76.00	
*9—Miles of No. 6 wire, weight 3,600 lbs.; poles, inc. cross arms, insu-		

lators, pins, etc.; line construction; 5—arc lamps, at $25	1,550.00	
60—Series incandescent lamps, at $7..	420.00	
90—Recording wattmeters, at $12....	1,080.00	
Total		$ 3,771.00
Total central station cost		10,275.00
Total first cost of entire installation		$14,046.00
10 per cent. for extras		1,417.00
Grand total		$15,463.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—

Fixed charge, including depreciation, insurance, and taxes, 10 per cent	$1,558.80
Engineers' salaries (2 men; one at $720, one at $600)	1,320.00
Superintendent's salary	900.00
Coal, 700 tons, at $2.75 per ton	1,925.00
Oil, waste, etc	100.00
Incidentals (supplies)	200.00
Office expenses	250.00
Total operating expenses	$6,253.80

Income—

Arc lamps, $70 each	$ 350.00
Series incandescent	1,350.00
Power (a conservative estimate)	2,800.00
Commercial lighting	3,450.00
Total	$7,950.00
Total operating expenses	6,253.80
Profits to be divided among stockholders or set aside for sinking fund	$1,696.20

Equals 10.89 per cent. on money invested.

When operating 24 hours per day at an average load of 14.7 kw. (19.7 h. p.) per hour, the output of the plant will be 35.2 kw.-hr. (472 h. p.-hr.) per day, or a total of 128,500 kw.-hr. (172,000 h.p.-hr.). This figure divided into $6,253, the total operating expenses for the year, shows a cost of approximately 4.85 c. per kilowatt-hour for the power generated.

The revenue from the various classes of service and the proportion of the total kw.-hr. output represented by each may be enumerated as follows:

Street Lighting (All Night Service)—

The load represented by this class of service, including 15 per cent. for loss in transmission is 25,530 kw.-hr. or approximately 20 per cent. of the total output.

Power—

We have previously assumed a power load 59.6 kw. (80 h. p.). If 700 kw.-hr. per year equals the consumption per connected h. p., the total load from this class of service would be 56,000 kilowatt-hours. At 5 c. per kw.-hr. this service would yield an income of $2,800. The total load represented plus 25 per cent. for loss is approximately 70,000 kilowatt-hours, or 55 per cent. of the total output.

Commercial Lighting Load—

As has been already stated, the total connected commercial lighting load in this plant will be approximately 60 kw.; 50 per cent. of this load, or 30 kw. will be the peak load taken by the commercial lighting service at any one time, and 17½ per cent. of this peak load may be considered average load which will be demanded during a period of 12 hours. On this basis we have a consumption of 23,000 kilowatt-hours per year paid for at the rate of 15 cents per kilowatt-hour.

Assuming that but 70 per cent. of the generated power is delivered and paid for, the station output for this class of service will be 33,000 kilowatt-hours per year, which amount allows the large item of 10,000 kw.-hr. for line, transformer, and meter losses and for bad debts.

Gas Engine Plant—

For localities where natural gas can easily and cheaply be obtained, in which the price of coal is so high that gas presents itself as a more attractive fuel from a financial standpoint, we would recommend an installation using gas engines. The size of the equipment will be estimated in the same manner as it was for the steam plant. The connected load will also be the same.

A plant of 100 kw. capacity would be of ample size to furnish this amount of energy.

The total cost of a building including the foundation and real estate should not be more than $1,200.

LIST OF APPARATUS IN GENERATING STATION.

2—75 h. p. gas engines, complete with 50 kw. generators	$ 8,000.00
Foundations, each $100	400.00

Installation, each $150	300.00
2—3¼ kw. CQ exciters, each $150	300.00
2—Belts, each $10	20.00
Switchboard	500.00
1—Constant Current transformer	200.00
1—2 kw. transformer for station lighting	30.00
Installation, wiring, foundations, etc.	220.00
Total	$ 9,990.00
Building, including real estate	1,200.00
Line material, same as in steam plant	3,896.00
Legal expense	350.00
Total	$15,436.00
10 per cent. additional	1,543.00
Grand total	$16,979.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—

Fixed charge, including depreciation, insurance, and taxes at 10 per cent.	$1,697.00
Engineers' salaries (2 men; one at $720, one at $600	1,320.00
Superintendent's salary	900.00
3,599,000 cu. ft. of gas at 30 c. 1,000 cu. ft.	1,080.00
Oil, waste, etc.	200.00
Incidentals	400.00
Office expenses	250.00
Total operating expenses	$5,847.00

Income—

Revenue, same as from steam plant	$7,950.00
Total operating expenses	5,847.00
Profits to be divided among stockholders	$2,103.00

This equals approximately 12.4 per cent. on the money invested.

This is based on the assumption that gas is available at 30c. per thousand cubic feet, and that the fuel consumption will not exceed 28 cu. ft. per kw.-hr. While this consumption may very probably be materially bettered it is in line with the conservative assumptions made on fuel consumption of steam engines.

PLANT FOR LIGHTING ALONE.

In communities where there is no present possibility of developing a day load and where it does not seem expedient to run a plant continuously, it will be necessary to figure on the correct installation for a plant running from sundown until, let us say, 1:00 a. m., but consideration must be given to the fact that within a few years 24 hours service will be demanded.

The size of the equipment for such a plant is arrived at in exactly the same way as in the case of the 24-hour installation, except that in this case there will be no day load, and we cannot expect to have quite as large commercial incandescent load.

The connected lighting load for a plant operating 6 hours a day in a town of this size usually consists of:

1,200—16 c. p. multiple incandescent lamps, equal to 48. kw.	64.4 h. p.
60—60 watt series Incandescent lamps, equal to 3.6 kw.	4.83 h. p.
5—arc lamps, 2.5 kw.	3.35 h. p.

As has been stated, fifty per cent. of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to midnight, therefore, the total load on the station will not exceed 50 per cent. of the connected incandescent load, 48 kw., or 24 kw., plus 6.1 kw. the arc load necessary for street lighting, or 30.1 kw.; this does not include 10 per cent. for line loss.

A plant of 50 kw. (67 h.p.) capacity would be of ample size to furnish this amount of energy.

The total cost of the building, including the foundation and real estate, should not be more than $1,250.

LIST OF APPARATUS IN GENERATING STATION.

Boiler Room—		
1—70 h.p. return tubular boiler at $725	$725.00	
Masonry	300.00	
Piping, including connection to engine	200.00	
Foundations for heater and pump	25.00	
Haulage	40.00	
1—Steel stack, 100 h.p.	135.00	
1—Feed water heater, 100 h.p.	125.00	
1—Boiler feed pump, 100 h.p.	75.00	
1—Injector, $15 each	15.00	
Total		$1,640.00
Engine Room—		
1—75 h.p. high speed simple engine	$1,050.00	
Foundations	50.00	
Installations	95.00	
1—50 kw. (67 h.p.)		

generator	805.00	
2—Belts	55.00	
1—3½ kw. CQ exciter	180.00	
Switchboard	200.00	
1—Constant current transformer for station lighting	40.00	
1—Constant current transformer	270.00	
Installation, wiring, foundation, etc.	150.00	
Total		2,895.00
Building, including real estate		1,250.00
Franchise and legal expenses		350.00
Total central station cost		$6,135.00

These figures are conservative, and it is probable that, by careful supervision, the cost of the plant could be considerably reduced.

The method of distribution and the cost of the material required for that purpose will be practically the same as that given for the 24-hour day plant in the first part of this article.

Total cost line material	$3,570.00
Total central station cost	6,135.00
Total first cost of entire installation	$9,705.00
10 per cent. extras	970.00
Grand total	$10,675.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—		
Fixed charge, including depreciation, insurance, and taxes at 10 per cent	$1,067.00	
Engineer's salary	720.00	
Coal, 350 tons at $2.75 per ton	962.50	
Oil, waste, etc.	75.00	
Incidentals	125.00	
Office expenses	200.00	
Total operating expenses	$3,149.50	
Arc lamps, $65 each	$325.00	
Series incandescent lamps, $18	1,080.00	
Com. lighting	3,080.00	
Total		$4,485.00
Total operating expenses		3,149.50
Profits to be divided among stockholders		$1,335.50

This equals approximately 12.8 per cent. on money invested.

When operating six hours per day at an average load of 17.5 kw. per hour, the output of the plant will be 115 kw.-hr., or a total of 42,200 kw.-hr. Dividing $3,149, the total operating expenses for the year, by this figure, we have a cost of approximately 7.5 c. per kilowatt hour for the power generated.

The revenue from the various classes of service and the proportion of the total kilowatt-hour output represented by each may be enumerated as follows:

Street Lighting (Midnight Service)—

The load represented by this class of service, including 10 per cent. for loss in transmission, is 16,600 kilowatt-hours, or approximately 39 per cent. of the total output.

Commercial Lighting Load—

As has been stated, the total connected lighting load in this installation will be 48 kw., and 50 per cent. of this load, or 24 kw., will be the peak demanded by this class of service. The average load required during the period of service, i. e., until 1 A. M., will be approximately 35 per cent. of this peak, or 8.6 kw., which amount will mean an annual consumption of 20,500 kw.-hr. paid for at 15 c. a kw.-hr.

Not more than 80 per cent. of the generated power will be delivered and paid for. The plant must therefore generate 25,600 kw.-hr. per year, which allows 5,100 kw.-hr. for line, transmission and meter losses and bad debts.

GAS ENGINE PLANT.

As in the 24-hour plant, natural gas, if it can be obtained at low rates, makes a very attractive proposition. A plant of 50 kw. (67 h.p.) capacity would be of ample size.

The total cost of such a building, including the foundation and real estate, should not be more than $1,000.

LIST OF APPARATUS IN GENERATING STATION.

1—75 h.p. gas engine, complete with 50 kw. generator	$4,000.00
Foundations	200.00
Installations	150.00
1—3½ kw. CQ exciter	150.00
1—Belt	10.00
Switchboard	200.00
1—Constant current transformer	220.00
1—2 kw. transformer for station lighting	30.00
Installation, wiring, foundation, etc.	160.00
Total	$5,120.00

Legal expenses	350.00
Building, including real estate	1,000.00
Line material, same as in steam plant	3,896.00
Totai	$10,366.00
10 per cent. additional	1,036.00
Grand total	$11,402.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expense—

Fixed charge, including depreciation insurance, and taxes at 10 per cent	$1,140.00
Engineer's salary	120.00
1,200,000 feet of gas at 30 c.	360.00
Oil, waste, etc.	125.00
Incidentals	225.00
Office expenses	200.00
Total operating expenses	$2,770.00

Income—

Revenue same as from steam plant	$4,405.00
Total operating expenses	2,770.00
Profits to be divided among stockholders	1,635.00

Equals approximately 14.5 per cent. on money invested.

This is based on the assumption that gas is available at 30 c. per thousand cubic feet, and that the fuel consumption will not exceed 28 cu. ft. per kw.-hr.

MUNICIPAL OWNERSHIP.*

By J. W. Dappert, City Engineer, Taylorville, Ill.

MUNICIPAL ownership, as usually applied, is ownership by a city or other corporate government of some one or more public utilities, which from some inherent quality inevitably tend to become monopolies. In a broader sense, the term might be applied to a city owning and operating any or all kinds of business. In these remarks the term is used in the more restricted sense to apply to heating, lighting, furnishing water to the municipality, operating street railways, and like enterprises.

It is believed that the trend of public sentiment is growing more and more in favor of municipally owned and operated plants, and especially is this so in the United States. The reason for the growth of sentiment favorable to municipal ownership is largely due to decreased cost of service given. A few examples are as follows:

In Massachusetts, in 1904, 51 private companies supplied water to a population of 211,467, while 129 municipal plants supplied 2,378,570 people. All cities of the State own their water works, and all but three of the larger towns either own them or are arranging to do so.

In the entire United States the only cities of over 110,000 population which rely upon private water works are San Francisco, Cal., Denver, Colo., and Indianapolis, Ind., leaving 36 of our largest cities supplied by municipal plants. Of 33 cities in the United States having a population of over 60,000 and under 110,000, but 10 rely upon private water works. Of the smaller cities in the United States having a population of less than 60,000, considerably more than half of them own their own water works; 766 cities and towns of more than 3,000 population own their own water works plants, as compared with 661 places served with private companies.

On November 12, 1909, the sentiment of the citizens of San Francisco, Cal., was favorable to municipal ownership of water works, as shown by a vote of 6 to 1. An elaborate system of water works is now being planned. New York City owns its docks, Boston its ferries, and Chicago by a popular vote in 1902 adopted municipal ownership of street railways, gas and electric railway plants, which has not yet come to pass fully, but it has for many years owned and operated its water works, with 2,000 miles of main supply pipes.

Municipal ownership of electric light plants has grown rapidly in recent years. In the past 25 years the municipally owned light plants in the United States have increased from 1 to 1,050; private plants have increased from 7 to 3,234; 13 light plants have been changed from municipally owned to private ownership, and 170 changed from private to municipal ownership. Canada has 80 municipally owned light plants, while in England over two-thirds are municipally owned.

In Wisconsin the municipally owned light plants have increased from 3 1/3 per cent. to 38 per cent. in 17 years. In 11 Wisconsin cities the light plants and water works are operated together.

Nashville, Tenn., built its own light

*A paper before the Illinois Society of Engineers and Surveyors.

plant in 1902, and in one year furnished more than double the light previously supplied by the company at a cost of $15,770 less, while the old company furnished commercial lighting at one-third of the previous rate.

Public gas plants are owned by Richmond, Va., Wheeling, W. Va., and Duluth, Wis. Very many smaller municipalities own one or more of the public utilities. Many of the state legislatures during recent years have passed laws authorizing municipalities to purchase and erect water works and lighting plants, and authorizing extra taxation or bond issues to accomplish the same. There has also been a growing tendency upon the part of the municipalities to limit the franchises which they grant to corporations, with the idea of making municipal ownership possible in the near future.

In the old world, notable instances of successfully managed municipal plants are the street railways of Glasgow, Scotland; Plymouth, Blackpool, Liverpool, Sheffield, Hull and Southampton, England, and Belfast, Ireland.

Hull, England, is a notable example of benefits accruing from municipal ownership. Up to 1899 no improvements had been made by the city. The streets were narrow and badly paved, and transportation poor. After adopting the idea of municipal ownership, the city broadened and paved the streets, acquired the street car lines, modernized them and placed them on a paying basis. The city also acquired and improved the docks, built fountains and beautified its public grounds. The result has been a rapid increase in population and greatly improved business. It now has 12 miles of double-track street railways, which is being added to, and charges 2 cents a trip. The financial returns are $122,000 annually after providing for interest and sinking funds.

Liverpool, England, has acquired municipal ownership of its street railways, and, in spite of reducing the fare to 2 cents, has increased its mileage, advanced the wages of its employes, increased the length of ride for a single fare threefold, increased the average speed from 5½ to 8 miles per hour, kept its property in good repair, paid all operating expenses out of revenues derived, set aside a sinking fund of $2,846,186, contributed to the reduction of taxes by paying $490,860 into the city treasury, and reduced its capital obligation $539,460.

London, England, is an example of the extreme exploitation of the city by corporations. It has 31 companies and local administrations supplying electricity, 8 water companies, and a large number of different corporations operating surface and underground railways. The public service is mostly very poor, and there is more local travel by means of bus and cab than upon the street cars. It also is said to have the worst managed port in the world, operated privately or by a corporation. It is noteworthy that the municipal government of London in 1905 built and is operating 6 passenger steamboats upon the river Thames, and that steps were taken by the general government to acquire all the telephone systems of England by the year 1911.

In the British possessions of North America many, and indeed most, of the larger cities own their public utilities. Winnipeg, population 145,000, owns its own water supply, water-softening plant, garbage crematory, and was upon the point of establishing its own lighting system when the local company reduced rates greatly, thus postponing the time when the city will install its own lighting service. It also does its own work of sewer construction, laying water mains, paving, street repairs, and making all other improvements by day labor.

In Germany most of the public utilities are under the management of either the central government or local municipal governments. Consul T. H. Norton reports that 58 cities with a population each of 50,000 or more own and conduct some or all of their public utilities, including water works, gas works, electric light and power plants, street railways, public bath houses, market halls, garbage removal plants, etc. Also 22 cities of the class named provide tenement houses at low rates for municipal laborers and employes. Of the 44 cities named owning gas works, the net annual profits upon this item alone are $10,000,000. Of this sum $2,500,000 is required for interest, and of the balance more than half goes toward a reduction in taxes.

Vienna, Austria, besides owning its own tramways, electric lighting system, gas works, etc., also owns grain elevator, central cattle market, restaurants, breweries, five savings banks, life insurance, funeral and undertaking establishments, and is about to purchase its own coal mines.

Multiplied instances could be given of cities owning some one or more public utilities and being well satisfied with the results. It is also true that there are many instances in which municipal ownership has not proven to be all which was expected

of it. It is, however, probable that the cities and municipalities of the United States are adopting more and more, each year, the idea of municipal ownership of public utilities, and, if so, what is the reason for it?

Answer: greed of the public utility corporations. If the public service corporations would be satisfied with a reasonable profit, with small dividends upon actual and not watered stocks, and if they would recognize the fact that the people which they serve have rights, as well as themselves, their lease of life might be increased. Publicity, it seems, would be the one thing which is needed to act as a sort of equalizing influence, to keep the municipalities from being exploited beyond reasonable measure, and yet allow the corporations to make a reasonable profit upon their investments. In cases where conditions become unbearable, and usually not until then, the municipalities adopt municipal ownership.

NEW BRITISH SEWAGE DISPOSAL WORKS.

By a Special Correspondent.

SHEFFIELD has opened the first section of her extended reconstructed sewage works. Established three miles from the center of the city, the scheme marks the first stage in the work of substituting the bacteriological process of sewage purification for that of lime precipitation, followed by aeration over weirs and continuous filtration through coke. The latter system, which was considered very satisfactory at the time the works were opened, is regarded as insufficient by the Local Government Board and the Yorkshire Rivers Boards, their attitude being that it is solely a process of clarification, which has no effect on the dissolved impurities in the sewage, and therefore cannot prevent subsequent decomposition of the effluent after discharge into the river. Experiments in the bacteriological treatment have been made by the corporation for ten years past, and it was ultimately decided to adopt a scheme for purification by this process, consisting of continuous-flow settling tanks and contact beds.

The work, which includes the remodeling of the present system, comprises the following: New outfall sewer and main valve chamber; two new catchpits and alterations to the two existing catchpits; nine new settling tanks and conversion of the existing tank area into eight additional tanks; deepening the two existing sludge wells and remodeling the pumping plant; 60 half-acre contact beds; 16 acres of storm beds; bridge and siphons across the river Don, roads, railways, etc. The estimated cost of the work is $1,351,845, exclusive of land and second contact beds. The gross area of the land which will ultimately be available is 204 acres, and the approximate cost $430,000.

The works will be capable of dealing with a maximum rate of flow of 64½ million gallons in 24 hours, this quantity being determined chiefly by the fact that the Local Government Board require provision for treating in periods of storm about six times the dry-weather flow. The scheme is based on a dry-weather flow, including trade wastes, of 12 million gallons a day. The filling material of the contact beds is screened clinker, graded from coarse to medium, and fine on the top, and the average depth is 4 ft., the floors being graded to the outlets.

After leaving the settling tanks, the sewage will pass along the main conduit and branches to a feed culvert communicating with a circular distributing chamber in the center of each bed, whence it will be distributed over the surface by means of channels formed in the surface of the filling. The works now opened consist of the altered catchpits and sludge wells, six new settling tanks, and twelve contact beds, and will treat a maximum flow of six million gallons a day. This quantity will be rapidly increased to twelve millions as twelve other contact beds, the construction of which is completed, are filled with clinker.

When the entire scheme is completed it will represent 460,000 cubic yards of excavation, 57,000 cubic yards of concrete, 29,000 cubic yards of brickwork, 180,000 tons of clinker, 80 acres of 3-in. concrete floors, 40 miles of drainage tiles, 3½ miles of conduits and subconduits 5 ft. wide and over, and 2 miles of culverts 2 ft. to 5 ft. wide.

Another great sewage scheme that will soon be in operation here is that of the Cardiff Corporation in South Wales. The new main outfall sewer is under construction, and the necessity for this new scheme has arisen solely from the inability of the present sys-

tem to cope with storm water. The existing outfall basin is small, and the outfall is tide-locked for about five hours during every tide. The district is low, and the object of the present scheme is to remedy the difficulties created by the low level and to obtain a free discharge of sewage and storm water at all states of the tide. The invert level at the termination of the sewer, therefore, was fixed at 20 ft. above ordnance datum, which is about the same as high water of mean spring tides, with an outfall conduit leading therefrom and terminating at low water mark of mean spring tides. This, of course, necessitated pumping as one of the main features of the scheme. The present main sewer will be intercepted at three points, whence the new intercepting sewers—two of which will be barrel-shaped, 4 ft. in diameter, and the third egg-shaped, 3 ft. 9 in. by 2 ft. 6 in.—will converge to a junction in Penarth Road. From the last-named point a 6-ft. circular sewer will convey both the dry-weather flow and the storm water along Penarth Road for a distance of 1,500 yards at a gradient of 1 in 1,650 to the pumping station. The whole of the sewage up to a maximum rate of pumping equivalent to 150 gallons per head per day of the population will be pumped to a height of 56.5 ft. above ordnance datum, or a total lift of 61.5 ft., whence it will gravitate to the outfall. The storm water over and above this quantity will discharge into the river Ely, which is a tidal river. Discharge will be free until mean tide level is reached, after which pumping will be resorted to, the maximum head of tide to be pumped against being 32 ft.

The screening chamber consists of two compartments fitted with penstocks on both the inlet and outlet ends, so that one may be made accessible for cleaning or repairs while the other is in use. Immediately beyond the screening chamber a weir has been constructed for the purpose of forming a storm water overflow. The normal flow of sewage will thus be diverted to the pump-well for delivery through the rising-mains to the outfall at Lavernock, while storm water will flow over the weir through the conduits for a distance of 130 yards into the river Ely. The overflow conduit consists of 4-ft. cast iron pipes.

The pumping station buildings consist of an engine room, 75 ft. by 41 ft.; gas engine room, 25 ft. by 41 ft.; boiler house, 64 ft. by 50 ft.; pump chamber, 73 ft. by 40 ft.; workshop, 20 ft. by 18 ft.; and office, mess room, stores, etc. The pumping plant comprises vertical plunger pumps driven by steam engines for dealing with the ordinary sewage, and centrifugal pumps driven by gas engines for the storm water. The steam-driven plant comprises four sets of compound, condensing, vertical steam engines, each of about 60 i.h.p., and capable of pumping continuously at the rate of 150,000 gallons an hour, and two smaller sets, each of about 20 i.h.p., capable of pumping 50,000 gallons an hour. The storm water plant comprises two sets of centrifugal pumps direct coupled to vertical gas engines, each of about 150 b.h.p., and capable of discharging 680,000 gallons an hour against the head caused by the highest tides.

From the head of the gravitation sewer to its termination at Lavernock is a distance of 4.4 miles, the last 1 1/2 mile of which consists of a reservoir sewer 13 ft. in diameter. The trunk sewer, which is 4 ft. 9 in. in diameter, and is laid at a gradient of 1 in 1,950, extends from the top of the rising-mains to the beginning of the reservoir sewer, a distance of about 3.3 miles. The greatest depth below the surface of the ground to the invert is 172 ft., while for 80 yards the sewer is carried above ground on a concrete wall.

With the exception of a length of about 450 yards, the whole of the work has been carried out in tunnel at depths varying between 16 ft. and 172 ft. below the surface. The reservoir sewer is 1.08 mile in length and of horseshoe section. It has been carried wholly in tunnel at depths from 22 ft. to 122 ft. to invert below the surface. The penstock and overflow chamber forming its termination are built near the face of the cliff at Lavernock Point. The chamber is constructed of brickwork, built in cement mortar, and roofed over with a semi-circular arch 14 ft. 6 in. in span. A masonry weir is carried up to a height of 17 ft. above the invert level, thus impounding not less than 4½ million gallons; above this height overflow will take place in case the sewer should become surcharged during the hours between the period sanctioned for ordinary discharge. The outfall conduit from the penstock chamber across the foreshore to low water of spring tides is 546 yards in length, of which 41 yards is in tunnel through the cliff. The conduit consists of 36-in. cast-iron pipes, with turned and bored joints, embedded in cement concrete in a trench through the rock.

EDITORIAL COMMENT

Municipal Electric Lighting in Boston

The Illinois Bill for Commission Government

MUNICIPAL ELECTRIC LIGHTING IN BOSTON.

The city of Boston under the later administrations seems to have been unwilling to avail itself of the services of the state Board of Gas and Electric Light Commissioners and to have been willing to pay a rate for arc street lighting which is materially higher than that paid by most large cities.

In 1907 the state board held hearings on a petition of the Public Franchise League of Boston and recommended reductions in the maximum commercial lighting rates from 15 to 12 cents per kilowatt hour, but the inquiry did not extend to the price of street lights, as that subject was at the time under discussion between the city and the company directly. The rate prior to that time was 34 cents per lamp per night, or $124.10 per year.

The state board in its investigation went into the question of the cost of furnishing light by the company, including the reasonable return on a reasonable valuation of the plant, but not very exhaustively, and definitely excepted the street lighting plant, with the statement that this could be done because the street lighting system was operated independently of the other business of the company, so far as the operation and maintenance charges are concerned. The board has full authority to make these investigations, much more than the city has.

The company made its charges for commercial lights on a rather complicated maximum demand system of rates and discounts whereby the primary and secondary rates are 20 and 5, 15 and 12, 15 and 9, and other rates are 13, and 15, 6, 5, 3, $2\frac{1}{2}$, varying according to kind and amount of service. There are also discounts which, for some large consumers, may be as much as 50 per cent on part of the bill. The rates for lighting city buildings were the same as for other customers, but the discounts begin at a smaller bill for the month.

The state board recommended the reduction of the commercial rate to a flat rate of 12 cents and that if a customer preferred the present system of charges his bill should be so modified that he would never pay more than 12 cents. The board also condemned the special rates given a few customers, including the city, and recommended their discontinuance. The net result to the city was, therefore, an increase in rates.

The result of the discussion of arc street light rates between the city and company was a five-year contract at $103.54 per lamp per year.

At the last meeting of the old council, held February 3, a report was presented claiming that the city's rates are exorbitant, and giving some figures to demonstrate it. As compared with the Boston price, Baltimore paid $67.49, Washington $85, Cincinnati $72, New Orleans $85, Pittsburg $90, all served by conduits, while Baltimore, which owns the conduits, pays $57 for lights on the conduit lines. Hartford pays $60 for overhead wire service and $64 for conduit service. St. Louis has a contract for $50 a lamp, the beginning of which has been anticipated by the company.

The street lighting plant of the Boston company being so nearly independent of the other business of the company, it would seem to be easy, at least through the state board, to determine the fair price for arc lights if the city authorities so desired. The new city administration may be able to take the matter up even if there is a long term contract now in force.

In the same way the report shows the

excessive rates for lighting city buildings, the rates being 3½ cents per kilowatt hour in San Francisco, Chicago and Providence, 3¾ cents in St. Louis, and 6 cents in Washington, New Orleans, Indianapolis and Baltimore, as compared with about 10 cents in Boston. The San Francisco company receives an average price from all its business of 4¼ cents a kilowatt hour and the report states that the Boston company receives about 7 cents. However, before the hearing in 1907 and the proposed 20 per cent reduction in the maximum demand rate and the elimination of special contracts and special discounts to certain customers, the average receipts from regular large users were 7.2 cents per kilowatt hour; for the small consumers, including three-fourths the total number, were 14.2 cents; for churches were 13 cents; for power were 5.6 cents; for elevators were 8.5 cents; for the city were 7.13 cents; and for those under special contracts were 3.61 cents per kilowatt hour.

It is evident that further readjustment is necessary, and the new administration can make one good record by taking the necessary steps toward that end.

THE ILLINOIS BILL FOR COMMISSION GOVERNMENT.

The Senate of the State of Illinois has just passed a bill providing for the adoption of a commission form of government by any city or village of less than 200,000 population so desiring, the provisions of which will be of interest although the bill must pass the House of Representatives before it becomes a law.

On petition of one-tenth the number of voters at the last election of mayor or president an election is held to decide whether the commission form of city government shall be adopted.

If it is adopted, a mayor and four councilmen are elected. They are nominated on petition of 25 voters for each candidate, and the candidates are voted for in a primary election, on the ballots for which the names of the candidates for mayor are arranged alphabetically and the names of the candidates for the four commissioners' places are arranged in another alphabetical list. The laws for registration of voters apply to the primary election.

The two receiving the highest numbers of votes for mayor and the eight receiving the highest numbers of votes for commissioner are the nominees to be voted for at the regular election, ballots containing the names in alphabetical arrangement, two in the list for mayor and eight, or less if there were not so many candidates at the primary, in the list for commissioners.

Three commissioners constitute a quorum and a majority. The mayor has a vote and has no veto, but every measure passed must be signed either by the mayor or by two commissioners. The commissioners as a whole have the power of the present city council and the administrative duties are distributed among the commissioners, one managing the department of public affairs, one accounts and finances, one public health and safety, one streets and public improvements, and one public property. The mayor takes the first department and the council at its first meeting assigns the other four. It also prescribes number and duties of employes. The council elects a list of city officials in which the city engineer is conspicuous by his absence, and also elects the heads of the principal departments subordinate to those of which they are individually the superintendents. Appointees are subject to such civil service regulations as are already in force.

Salaries run from $50 for mayor and $40 each for councilmen in towns of less than 2,000 population to $6,000 and $5,500 in cities of over 100,000 population at the national or state census next preceding their election. Other salaries are fixed by the council but cannot be changed during the six months preceding the regular biennial election.

Grants of franchises for public service utilities must be approved by a general or special election.

If a petition signed by twenty-five

per cent of the number of voters at the last election of mayor is filed after three months' incumbency, an election is held to vote for a successor to any elected officer whose displacement is desired, the primary election preceding as in the regular election.

Ordinances may be presented on petition of twenty-five per cent of the voters, and in such case the council shall pass them without change or call a special election. If the petition is signed by at least ten per cent of the voters, the ordinance must be passed or submitted at the next general election.

All ordinances except those concerning public peace, health or safety with emergency clause and passed by two-thirds vote (which would seem to be four votes) go into effect only after thirty days from date of final passage, and if ten per cent of the voters so petition during the thirty days the ordinance is suspended, and if not repealed by the council is submitted to popular vote.

Public service corporations must supply equal and uniform service to all without discrimination as to rate and no free service is permitted except transportation of firemen and policemen in uniform, unless authorized by ordinance. Both the public service corporation and the recipient of an unauthorized preference as to service or rate are subject to fine or imprisonment.

A city auditor is appointed by the judges of the circuit court, to serve at salary fixed by the council and under bond approved by mayor and commissioner of accounts and finances. He examines books of all officers, approves claims against city and countersigns warrants drawn on appropriations previously made.

After four years' trial a town or city may vote to return to its original form of government.

The Senate added a number of amendments regarding the regulation of corporations, limiting their franchises to twenty years; limiting issue of stocks and bonds to money, labor or property actually received at reasonable value; requiring payment to city of at least three per cent of gross revenues; providing for publicity of their accounts, and fixing methods of enforcing the law and penalties for violating it.

In general the proposed law seems to be applicable to the smaller cities and should be very satisfactory. A few doubtful points will be noted, but they are not fatal to the success of the law if administered by its friends or closely watched by them.

The auditor provided for may to a large extent take the place of the finance commission provided for Boston. The provisions above noted make it possible for a hostile council to harass the auditor without opportunity for redress.

Where all candidates for public office are so well known as they are in the smaller cities, the commission form as prescribed in this bill is not so open to the criticism that it perpetuates the indefinite distribution of responsibility, which is the great defect of the present form of government by mayor and council, nor to the other principal objection that the qualifications of the superintendents of the various departments for their duties are altogether a matter of luck, it being almost impossible to elect a certain man for a certain department.

Whether the bill includes cities of too large size for satisfactory application of its principles is a question to be answered only by trial. It is probable that the plan will work much better in cities of less than 25,000 population than in those that are larger. The superiority of the Boston form of commission government, which makes the council responsible for legislation and the mayor responsible for the administrative departments, at least for the larger cities whose business is extensive enough to require the larger number of employes, is discussed in the December number of MUNICIPAL ENGINEERING, vol. xxxvii, p. 393.

Even the friends of the Illinois bill are doubtful of its ability to get through the House of Representatives, but its passage would mark a notable advance in municipal conditions in that state.

THE QUESTION DEPARTMENT

Effect of Length and Irregular Profile on Suction Line of Pump.

We have a case where a 10-inch cast iron bell and spigot pipe 1884 ft. long has been laid from a river to an industrial plant, through which it was intended to draw water for manufacturing purposes. At the river end there is a 10-inch riser for the purpose of raising water about 3 ft., thence through a 90 degree elbow, afterward a 10-inch swinging check valve, then the pipe is laid horizontally for several feet, where it is intercepted by a street main and makes a dip about the diameter of the 10-inch pipe, then it gradually rises to a height of about 5 ft. above the surface of the water at a point 800 ft. from the river. In the next 200 ft. it drops about 4 ft. and makes also a right angle turn. Beyond this it runs about level and makes two right angle turns, and its end is connected to a duplex pump of 750 gallons per minute capacity, when pumping against 100 lbs. pressure per square inch, and the pump running at a speed of 100 r. p. m.

The question which we desire to have you settle for us is whether it is possible to draw water through this pipe laid in such a manner, even though the pipe is absolutely free from any leakage. In the first place we considered it an impossibility and have since looked up such authorities as were available and while, in a general way they seem to confirm our belief at the same time we would like to have a direct expression from higher authority upon these points, and finally decided to refer the matter to you for an opinion. T. R., Ambler, Pa.

It will require a little more than 3 feet velocity in a clean 10-inch pipe for it to discharge 750 gallons a minute. The head necessary to produce this velocity, the loss of head at entrance of pipe and in bends and the loss of head due to the flow of water in the pipe at the required velocity together amount to nearly 8 feet. The addition of the loss of head in the check valve might easily increase the total loss of head to 9 feet, so that, with the 1 foot of elevation of pump end of pipe above water in river, the total suction lift would be 10 feet. As the pipe becomes older the coefficient of discharge becomes less, reducing to ¾ at 20 years, which would increase the velocity to 4 feet and would increase the total loss of head fully 50 per cent. To this loss of head must be added that in the pump itself.

But the two summits in the suction would produce the most serious effect, for air would collect in them and very seriously reduce if not wholly stop the flow of water at times. The suction pipe acts to some extent as a siphon, and the action of the air in the summits will be similar. To insure continuous action and prevent the troublesome if not dangerous pumping of air by the water pump, therefore, it will be necessary to apply to both summits one or another of the devices in use for removing air from siphon summits. The pump cannot act regularly or at full capacity unless such devices are supplied, if it can be started without them. It would probably require complete priming also.

What points can our readers make and what suggestions?

Bookkeeping for Metered Water System.

In our borough we buy our water from the Trotter Water Company on the following schedule of prices:

For the first 5,000 gallons per day of 24 hours, 25 cents per thousand gallons; for all water used over 5,000 gallons per day and up to 10,000 gallons, 20 cents per thousand; for all water used over 10,000 gallons and up to 200,000, 15 cents per thousand gallons. The borough is the water company. Every citizen is taxed to pay for laying the main pipes and setting fire plugs, and where any one living in the borough takes water he has to pay for piping the house and setting the meter at the rate of 25 cents per thousand gallons. We have some difficulty in making out the tickets and collecting the bills. Will your system suit our plans?

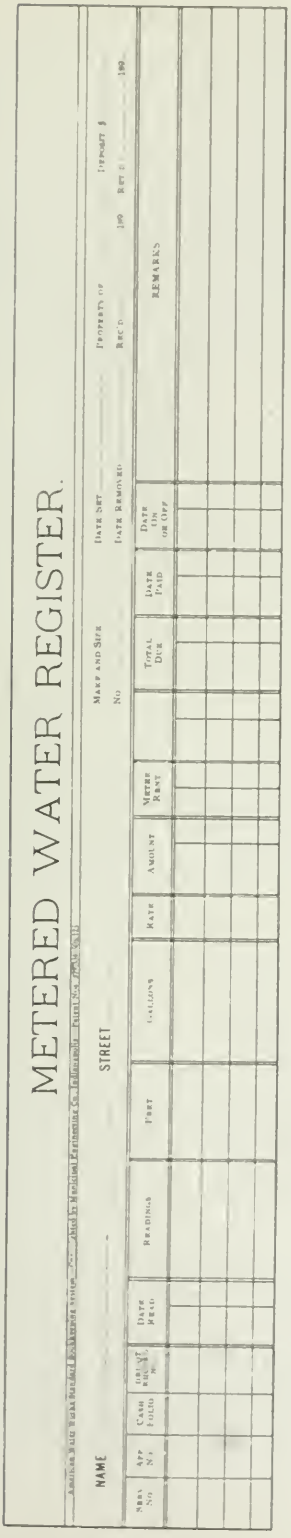
T. J. D., ——, Pa.

All the domestic users of water will fall under the first rate, so that the "Metered Water Register" in the "American Water Works Standard Bookkeeping System" will serve for keeping their accounts without modification.

A few manufacturers and such large users of water would be charged for water at two different rates, and a still smaller number at three rates.

For those who pay at two rates the following suggestion is made, assuming that meter readings are made monthly and are in cubic feet:

Assume that 150,000 gallons a month is the equivalent of 5,000 gallons a day. Write the total number of gallons used, as deduced from the meter readings in cubic feet, in the column headed gallons in red ink close under the line below. Deduct from this 150,000 gallons and write the remainder in black ink close under the red figures and on the line opposite the meter reading. Write the rate 20 in the column headed "Rate" and the amount due for the excess over 5,000 gallons at this rate in the column headed "Amount." Write in the column without heading $37.50, being the amount due for the first 150,-


METERED WATER REGISTER.

American Water Works Standard Bookkeeping System. Adopted by Municipal Engineering Co., Indianapolis. Patent Nos. 27,836 No. 15

NAME _____ STREET _____

MAKE AND SIZE _____ No. _____

DATE SET _____ DATE REMOVED _____

PROPERTY OF _____ REC'D _____ 189 DEPOSIT $ _____ REC'D _____ 189

SERV. NO.	APP. NO.	CASH FOLIO	ORIGINAL RECEIPT NO.	DATE READ	READINGS	FEET	GALLONS	RATE	AMOUNT	METER RENT		TOTAL DUE	DATE PAID	DATE ON OR OFF	REMARKS

000 gallons (5,000 gallons a day). It might be well also to have a stamp made reading "150,000 gal @ 25c" and stamp this in the column headed "Remarks." It is understood that there is no meter rent, so that the column headed "Meter Rent" can be used to enter the charge to pay for piping and meter setting at the rate of 25 cents a thousand gallons, computed from the red figures in the column headed "Gallons." If the charge ceases when the cost of piping and setting meter is all paid, the sum of the items in the column headed "Meter Rent" must be watched, so that the charge can be stopped when the total bill is paid. The total bill for the month will be the sum of the figures in the columns "Amount" and "Meter Rent" and the $37.50 in the column without heading. This column might have stamped or written in as a heading some such entry as "Chg at Max Rates."

A bill for this class of customers might be printed in the following form, all letters and figures given being printed and the blanks being filled out each month according to the computations from the meter readings:

Meter Reading ———— cu. ft. equal to ———— gal.

Charges for consumption:

150,000 gal. @ 25c.	$37.50
——— gal. @ 20c	———

Charge for piping and meter setting:

——— gal. @ 25c	———
Total due	$———

The sum of the 150,000 gallons and the ——— gallons at 20 cents should equal the ———gallons under the charge for piping and meter setting, and this latter amount is equal to the ——— gallons in the first line, "Meter Reading."

This bill is easily made out and is easily checked. The only additional information the customer could ask for is the standing of his account for piping and meter setting. A line stating his balance due on this account might be put in one corner of the receipt, or of the bill if it serves also as a receipt when it is stamped paid.

For the customers using more than 15,000 gallons a day the only changes necessary in the account book would be the insertion of $97.50 instead of $37.50 in the column without heading, and the use of a stamp for the column headed "Remarks," reading, "150,000 gal. @ 25c & 300,000 gal. @ 20c." The figure in the "Rate" column would be changed to 15 and the deduction from the red figure of total consumption would be 450,000 gallons to give the quantity to be paid for at the 15-cent rate.

The bill printed for this class of customers would have an additional line under that reading "150,000 gal. @ 25c.... $37.50," which line would read "300,000 gal. @ 20c....$60.00," and the next line would read, "——— gal @ 15c....———."

The bill used for the domestic customers and others using less than 150,000 gallons

a month would be the same as the above except that the line for the 150,000 gal. charge would be omitted and the remaining line under the "Charge for Consumption" would read, "——— gal. @ 25c.... ——."

The above assumes that meters are not read daily, but that the daily consumption is averaged from the monthly readings.

The accompanying diagram of the book described will serve to make the description clearer.

Have our readers anything to suggest that would be applicable to this case?

Forms of Receipt for Water Bills.

Please give sample forms of receipts used for water works in small cities.

F. B. S. Byron, Ill.

Will our readers engaged in water works operation send us copies of the forms of bills and receipts they use for publication?

Following are some forms in use in the smaller cities:

Payable to....., City Treasurer,
City Hall, ...
No... .....Mass., ...191..
Mr.....
.....Street, Ward, ...
To City of....., Dr.

For Meter Advance from.....
1, 191.. to.....1, 191.. $.....
For Meter Rent from.....
1, 191.. to.....1, 191.. $.....
.....
.....
$.....
Received Payment,
.....,
City Treasurer and Collector.

The face of the bill also bears the seal of the city, information about telephone calls and office hours, and the section of the water ordinance governing time of paying water bills. The back of the bill gives other sections from the water ordinance, including that governing rates.

Another form reads as follows:

If this bill is not paid in ten days after date, the water will be turned off. (In red.)

Hydrant.... ....., Ky., April 1, 191..
M.....
No....., ...Street.
To City Water Works, Dr.

Semi-Annual Water Rent for—
.....Dwelling $.....
.....Store .....
.....Extra Family .....
.....Bath .....
.....Wash Stand .....
.....Water Closet .....
.....Hose Attachment .....
.....Horse and Wagon .....
....

From this day to the 1st of October, 191.., upon the rules and conditions prescribed by law.

Received Payment, ..., 191..
.....
For the Works.

The back gives instructions, rates and regulations.

The following is a more complete form of bill for meter rates:

Register No...
Receipt No...
....., Minn., ... 191..
M.....
Premises.....
Water for Month of....., 191..

Meter this date .....cubic feet
Meter last month .....cubic feet
Consumption .....cubic feet
or .....gallons

....gals. at 20c per 1,000 gals. $.....
....gals. at 15c per 1,000 gals. $.....
....gals. at 10c per 1,000 gals. $.....
....gals. at 8c per 1,000 gals. $.....
$.....
Received Payment,
.....,
Water Commisisoner.
....., Deputy.

The face of the bill also carries the list of meter rates and instructions as follows: "Meter rates must be paid before the 10th of each month." "Please bring this bill with you." "7½ gallons in 1 cubic foot."

Following is a sample and convenient form of bill for flat rates:

Assessment for Water, No...
.....,
.....Street.
To City of....., Mass., Dr.

For Water from May 1, 191.., to May 1, 191.., as per items checked in schedule printed below. $.....

Then follows the water rate schedule for flat rates with a blank preceding each item for the check mark or number of fixtures under the item. Followed by the form

Received Payment,
.....,
City Treasurer.

A detachable slip for the treasurer's office reads:

.....Water No...
Amount $.....
Abatement $.....

The face of the bill carries the regulation concerning use of hose. The back of the bill carries extracts from the water ordinance and from the water board's regulations.

Criticism of these forms are invited.

Book on Water Works.

Gentlemen, would you kindly inform me what book you consider the best on water works and price of same.

J. D. M., Elko, Nev.

On the general subject of water works probably Turneaure and Russell's "Water Supply Engineering" ($5) is the best book. There are other excellent books, a list of the most important of which will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 175.

Trouble with Suction at High Water.

Our company has a water works plant with a capacity of 1,500,000 gallons per twenty-four hours. Our suction pipe is a ten-inch line, which can be doubled if necessary. Our lift is on an average fifteen feet, sometimes a little more, sometimes less, during high water when my trouble occurs. My suction line is provided with an Eddy foot valve (check). This suction line is provided with a brass wire over the mouth to prevent trash from entering it. Now as soon as the water reaches a point above the foot valve, my pumps begin to labor, to plunge, to knock, and the water they pump falls off to less than half. The higher the water reaches on the suction line the greater the laboring of the pumps and the less they pump. Is the trouble in the "foot valve" or does trash collect on the mouth of the suction pipe?

SUPT. WATER WORKS, ——, Tenn.

Will our readers suggest causes for the difficulty and methods of remedying it?

There seems to be an obstruction to the flow of water in the suction pipe, which increases as the water in the stream rises. If the difficulty is proportional to the height of the water, decreasing as it falls the difficulty would seem to be in the foot valve or the pipe itself. If the difficulty increases irregularly and does not decrease materially seem to be from obstruc-trouble would seem to be from obstruction of the intake. In such case it would doubtless be necessary to clear the trash from the intake before the pumps would return to their normal action. The letter gives no indication that this is necessary, so that probably this not the cause of the difficulty. A sketch of the suction pipe and of its connections with the intake and the pumps, showing its grades and valves, also a full description or drawing of the foot valve and its setting would aid in locating the trouble.

Price for Water for Ice Plant.

What is the average cost or rate for water for an ice plant using say about 35,000 gallons a day for say 6 months in the year?

C. O., Newton, Iowa.

Such service would best be paid for by meter measurement and could very properly be charged at the average cost of supplying the water, with a small percentage added for safety. The total expense of the works for a year, including operation, maintenance, repairs, depreciation and interest, divided by the number of thousand gallons pumped per year would give the cost per thousand, and the price charged might well be larger than this cost by say 10 per cent. There are several items which may require special treatment in determining the price. Thus the figures for repairs should be somewhat larger than the average per year during the history of the existing plant, and not the figure for any one year. The allowance for depreciation or sinking fund should be ample. Estimates for water works plants run from 3 to 6 per cent. The interest item should include not alone interest on the bonded indebtedness but upon the total value of the plant. The cost of pumping may be higher during the ice making season on account of limitations in capacity of the plant, in which case proper addition should be made.

Charges for the quantity of water named in 20 cities, taken at random from the rate cards on file, run as follows, $3\frac{1}{2}$, $7\frac{1}{2}$, 8, $11\frac{1}{4}$, 15 cents per 100 cubic feet; 6, 6, 8, 9, 10, 10, 11, 12, 13, 14, 15, 17, 18, 20 cents per 1,000 gallons. It is evident that an average taken from such widely varying prices is not very liable to strike the proper rate for any one plant.

Price of Cast Iron Pipe.

Will you tell me what is a fair price for 4-inch cast iron pipe?

F. L. T., Roodhouse, Ill.

Late bids for 4-inch cast iron pipe have been for $26 a ton. Differences in freight charges may make slight differences in price for pipe in quantity at Roodhouse. Four-inch pipe weighs 200 pounds per 12-foot length for light pipe, 215 pounds for 150-foot head, 230 pounds for 250-foot head and 250 pounds for 350-foot head.

Motive Power for Small Water and Electric Light Plant.

Our plant is water and electric. Our electric generator is A. C., 3 phase, 60 cycle, 2,200 volts. We are now figuring on changing our old steam-driven Gordon pumps to a more economical pump. Would you recommend pumping engines, or motor-driven pumps? If the latter is recommended, what, in your judgment, is the best on the market?

P., ——, Mich.

The data given are not sufficient for an intelligent answer to the question. In fact the engineer attempting to answer it should have an opportunity to visit the plant and investigate all the conditions.

Will our readers who know about the operation of combined water and electric light plants in cities of 3,000 to 6,000 population give some of their information for publication for the benefit of our correspondent and others?

Cities Having Both Municipal and Private Water Plants.

Will you pleast inform me if you know of any cities in which there are both municipal and private water plants and the names of any such cities.

J. DAVIS REED,
Mayor, Portsmouth, Va.

Large cities, such as New York, Chicago, Los Angeles, Pittsburg, Indianapolis, Camden, Austin, Niagara Falls, have both municipal and private plants, on account of the annexation of adjoining small towns.

The following cities and towns are reported to have two or more water plants.

one of which is under municipal ownership: Mobile, Ala.; Jacksonville, Fla.; Pueblo, Col.; Petersburg, W. Va.; Shenandoah, Millvale, Pa.; Gloversville, N. Y.; Nome, Alaska; East Providence, R. I.; Tyler, Tex.; Santa Rosa, Santa Barbara, Santa Cruz, Cal.; Montpelier, St. Johnsbury, Vt.; Grand Haven, Niles, Mich.; Cherryvale, Kan.; Montpelier, Ind.

There are also a number of places, most of them in New Jersey, where the water is supplied by a company and is distributed by the city. And there are other cities which own all or part of the water works plant and lease it to an operating company.

The latest report giving full details is in the "Municipal Year Book" for 1902 ($4), and there are doubtless some changes in the list since that date.

Books on Electrolysis.

Is there a book treating on electrolysis of water pipe, caused by electric railways, and the prevention of same?

J. P. L., Greenville, O.

Lists of books and articles on Electrolysis will be found in MUNICIPAL ENGEERNING, vol. xxxvii, p. 107.

Articles on Electric Wires and Lighting.

Could you let us know which numbers within the last two years have articles on electric street lighting and electric wires in streets? Some of our New Jersey municipalities are very much interested in this at the present time.

J. E. B., New York, N. Y.

The following are articles on the above subjects:

Vol. xxxiv, p. 235, "Flaming and Metallic Arc Lamps," defining the terms; p. 268, "The Duluth, Minn., Electric, Gas and Steam Engine Pumping Stations," a brief descriptive article, illustrated; p. 299, "Cost of Water, Gas and Electric Light," giving a list of prior articles on that and kindred subjects; p. 306, "Tests of Electric Lamps," a review of a bulletin of the University of Illinois; p. 370, "A Flaming Arc Lamp," giving a description of the Janders type; p. 371, "Specifications for Street Lighting," giving those prepared by a committee of the National Electric Light Association.

Vol. xxxv, p. 35, "Cost of Operating Municipal Lighting Plants," giving references to sources of information on the subject; p. 96, "Principles Underlying a Street Lighting Contract," as laid down by a committee of the Civic League of St. Louis; p. 234, "The Arc Lighting System of Portland, Ore.," a descriptive article; p. 383, "Prices of Water and Light," giving references to sources of information.

Vol. xxxvi, p. 33, "Rates for Lighting and Contract Provisions," giving rates in New York villages, and an outline of a contract of a city with a lighting company; p. 216, "Tungsten Lamps Compared with Arc Lamps"; p. 241, "Will Electric Light Plant Be Profitable," a brief statement of the matters to be considered; p. 315, "Information About Municipal Water Supply and Electric Light Plants," giving references to sources of information; p. 316, "Forms of Contract for Electric Current," giving contracts of municipal and private lighting plants with customers; p. 373, "Municipal Street Lighting Plant"; p. 390, "Report Adverse to Municipal Lighting in Spokane," a brief news note.

Vol. xxxvii, p. 37, "Terms for Renewal of Lighting Franchise," giving references to sources of information; p. 175, "State Regulation of Electric Light Rates," an editorial; p. 181, "Concrete Lamp Posts"; p. 189, "Cost of Street Lighting in Des Moines, Iowa"; p. 257, "Cities Owning Water and Light Plants," giving list of cities of 3,000 to 4,000 inhabitants; p. 324, "Cost of Electric Current," giving figures for cities from 75,000 to 125,000 population; p. 326, "Tungsten Lamps for Street Lighting," a brief note of progress; p. 397, "Water and Lighting Rates in Small Cities," and "Rates for Electric Current," giving references to sources of information.

Vol. xxxviii, p. 10, "Gas and Electric Competition About Boston"; p. 15, "Street Lighting"; p. 44, "Arc and Other Electric Lights," giving comparisons of experiences, costs, etc.; p. 107, "Books on Electric Light and Gas Plants," giving lists of books and articles; p. 108, "Distribution of Charges for Electric Power," showing how to make rates on maximum demand system.

List of Municipal Electric Light Plants.

Where can I get a list of municipal electric light plants with the names of officers, kind of motive power and other information?

A. D. E., St. Louis, Mo.

The *McGraw Electrical Directory* probably gives the information desired. It is published semi-annually at $10 a year.

Municipal Lighting Plant with Water Power.

I am told that you have some literature regarding the municipalization of the electric light by water power. As we intend to submit this case to the citizens of the town, you will greatly oblige me by sending a copy of this printed matter, if possible.

E. B., ——, Que., Can.

The only full discussions of this subject are in such books as Frizell's "Water Power" ($5); Lyndon's "Development and Electrical Distribution of Water Power" ($3); Beardsley's "Design and Construction of Hydro-Electric Plants" ($5); Adams's "Electric Transmission of Water Power" ($3), which can be furnished by MUNICIPAL ENGINEERING COMPANY at the prices quoted.

There are many articles on the municipalization of electric light plants without particular reference to the use of water power which can be found in the volumes of MUNICIPAL ENGINEERING. Lists of such articles will be found in vol. xxxviii, p. 107, vol. xxxvii, p. 324, etc.

Information About Municipal Lighting Plants.

There is very strong sentiment in this city in favor of a municipal electric lighting plant and we wish advice as to the cost of such a plant for a city of this size, namely about 25,000 population, and information as to where municipal lighting plants in cities of about this size have been installed. If you can give us any information as to the cost, we should appreciate the same and would likewise appreciate the information relative to the financial results where municipal plants have been installed in cities similar in size to our city. In fact, any information you can give us which you think will be of benefit in the matters referred to, I should like. If you are not able to furnish the data requested, if you can refer us to some person or company from whom we can obtain the same, it will be likewise appreciated.

W. E. G., ———, O.

The following data regarding municipal electric light plants are taken from the *McGraw Electrical Directory*, which also gives the details of equipment and contracts:

Argenta, Ark., 15,000 population, plant cost $60,000. City is charged $75 each for 69 arc lights.

Little Rock, Ark., 40,000 population, plant cost $55,000; 340 city arc lights.

Alameda, Cal., 20,000 population. City is charged $78 each for 500 24-c. p. incandescents.

Pasadena, Cal., 15,000 population, plant cost $350,000. City is charged $60 each for 308 arc lights and $12 each for 750 40-c. p. incandescents.

Norwich, Conn., 20,000 population, plant cost $690,896. Also buys current. City is charged $75 each for 235 arc lights and $15 each for 295 25-c. p. incandescents.

Jacksonville, Fla., 37,000 population, plant cost $520,872. City is charged $54 and $60 for 520 arc lights and $25 each for 166 59-c. p. incandescents.

Bloomington, Ill., 26,000 population, cost $40,000, has 420 arc and 400 16-c. p. incandescent lights, for street lighting only. Plant is under reconstruction.

Decatur, Ill., 25,000 population, cost $45,000, has 240 arc lights, for street lighting only.

Galesburg, Ill., 21,000 population, cost $40,000, has 200 arc arc and 550 incandescent lights, for street lighting only.

Jacksonville, Ill., 17,000 population, for street lighting only.

Springfield, Ill., 38,000 population, has 608 arc lights, for street lighting only.

Anderson, Ind., 21,000 population, cost $157,000. City is charged $70 each for 255 arc lights.

Fort Wayne, Ind., 51,000 population, has 420 arc lights for street lighting.

Hammond, Ind., 40,000 population, has street lighting plant.

Huntington, Ind., 20,000 population, 121 arc lights, for street lighting.

Marion ,Ind., 25,000 population, cost $24,000, 250 arc and 75 incandescent lights, for street lighting.

Richmond, Ind., 20,000 population, cost $212,000. City is charged $75 each for 315 arc lights.

Topeka, Kan., 42,000 population, cost $85,000, for street lighting.

Henderson, Ky., 17,500 population, cost $109,000.

Paducah, Ky., 23,000 population, cost $20,000. City is charged $51 each for 214 arc lights, for street lighting.

Bangor, Me., 25,000 population, has 410 arc and 1,800 incandescent lights.

Cumberland, Md., 20,000 population, cost $18,286, has 298 arc lights.

Hagerstown, Md., 16,000 population, $55,000 bonds authorized, has 310 arc and 5,000 incandescent lights.

Chicopee, Mass., 21,000 population, cost $142,481. City is charged $75 each for 225 arc lights and lights two other villages.

Holyoke, Mass., 51,000 population, cost $380,469. City is charged $60 each for 518 arc lights.

Taunton, Mass., 31,000 population, cost $125,000. City has 254 arc and 816 40-c. p. incandescent lights.

Bay City, Mich., 41,000 population, cost $78,000. City is charged $55 each for 444 arc lights.

Kalamazoo, Mich., 33,000 population, cost $65,000. City is charged $44 each for 380 arc lights.

Lansing, Mich., 23,000 population, $135,000 bonds. City has 230 arc lights.

Joplin, Mo., 45,000 population, cost $75,000. Has 250 arc and 3,000 incandescent lights.

Lincoln, Neb., 49,000 population, cost $85,000. City is charged $50 each for 330 arc lights.

Jamestown, N. Y., 27,000 population, cost $140,000. City is charged $51 each for 425 arcs and $18 for 32 48-c. p. incandescents.

Ashtabula, O., 16,000 population, cost $80,000. City has 130 arcs and 20 incandescents.

Hamilton, O., 28,000 population, cost $100,000. City has 365 arc and 125 tungsten lights.

Newark, O., 21,000 population, cost $65,000. City has 359 arc lights costing $17.25 a year each. For street lighting only.

Norwood, O., 21,000 population. Has municipal water and light plant which cost $125,000.

Easton, Pa., 29,000 population, cost $54,000. City has 300 arc lights. For street lighting only.

Norristown, Pa., 24,000 population, cost $43,368. City is charged $41.10 each for 216 arc lights, for street lighting only.

Austin, Tex., 23,000 population, has municipal water, light and power plant which has $1,300,000 outstanding bonds. City is charged $60 each for 188 arcs and 5 cents per kw. for 800 16-c. p. incandescent lights.

Galveston, Tex., 35,000 population, cost $25,000, has 500 arcs and 500 incandescents, for street lighting only.

Burlington, Vt., 22,000 population, $100,000 bonds. City is charged $65 each for 243 arc lights.

Danville, Va., 18,000 population, has municipal plant.

Tacoma, Wash., 38,000 population, cost $287,000, buys current at present. City is charged $72 each for 1,000 arc lights.

Wheeling, W. Va., 42,000 population, cost $100,000.

It is evident that the cost of the plant depends upon more than the size of the city. The best means of getting information concerning the financial results of operation of plants is through correspondence with the managers and study of their reports.

It is recommended that the proper department in the city from which the inquiry comes secure expert advice from an electrical engineer of good standing. Names of such engineers will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Civil Engineers" and "Consulting Engineers."

Books on Gas Plant Design.

Can you refer me to a good book or books that will assist me in making plans for a gas works for a city of 10,000 inhabitants? D., —— Ind.

The plant would probably be a water-gas plant, in which case some design on the market would probably be selected. Latta's "Handbook of American Gas Engineering Practice" ($4.50) will give a good view of the whole field and aid in making the proper selection of process and machinery. Newbigging's "Handbook for Gas Engineers and Managers" ($7) gives a view of English practice. Cripps's "Gas Holder and Tank Construction" ($1.50) and Hole's "The Distribution of Gas" ($5) are both English works and probably the best on their subjects. Hunt's "Gas Lighting" ($3.50), being the third volume of "Chemical Technology," is a good book. Webber's "Town Gas for Lighting and Heating" ($2) will give information about coal-gas plants. O'Connor's "Gas Engineers' Pocket-Book" ($3.50) contains tables and data.

Repressed vs. Plain Wire-Cut Brick.

During recent years most cities have adopted specifications for brick paving calling for repressed block, and text-books and other publications hold up the repressed block as the standard of excellence. In the face of these facts, the Dunn Wire-Cut-Lug Brick Company advertises its product by the circulation of literature designed to prove that the brick lose considerably in both density and toughness by the process of repressing, and quoting prominent brick manufacturers and others in confirmation of this statement.

If paving blocks lose instead of gain in quality in the process of repressing, how has it come about that the repressed block has been manufactured and used for a number of years to the almost total exclusion of the non-repressed block?

Do you know of any investigations or series of tests by disinterested parties to determine the effect of the repressing process on the quality of the product?

E. R. WHITMORE,
City Engineer, Port Huron, Mich.

This is a question which is open to discussion and MUNICIPAL ENGINEERING will publish contributions to the discussion if our readers will send them for that purpose.

The prevailing opinion about repressing brick is expressed by Professor Baker in the paragraph on repressing in his book on "Roads and Pavements" ($5). It is to the effect that repressing makes the brick more symmetrical, but, with variations due to character of clay and method of manufacture does not increase its solidity or decrease its laminations.

Repressing came into favor about 1895, but few repressed blocks having been laid prior to that year. There was much opposition to the process then, among manufacturers and engineers, and that opposition has not diminished. The writer laid the first repressed block street in Indianapolis in 1895, a heavily traveled pavement which is still in use. The fillers in general use in those days did not protect the edges of the brick and they soon chipped off, unless they were rounded in the repress. The fillers would not run into the joints unless the bricks were laid to give the joint, resulting practically in a rough, irregularly jointed surface, or projections or grooves were formed in the repress. These practical considerations and the improvement in appearance seem to have been the principal reasons for the sudden popularity of the form. There were also early claims of greater density and toughness.

Professor H. A. Wheeler, in his booklet, "Vitrified Paving Brick" ($1), published in 1895, which was the first technical treatment of paving brick and is still the best, aside from official reports on various parts of the subject, doubts the benefit to the brick, on account of the breaking up of the bond formed in the die by the differently applied pressure in the repress. He accounts for the slightly smaller abrasion loss by the greater breaking off of corners of square cornered brick in the early period in the rattler.

A booklet on "Brick Pavements" by W. W. Wallace, published the same year, shows the popularity of the repressed form by statements of specifications, Chicago, Louisville, Philadelphia requiring repressed bricks.

In the same year, 1895, the National Brick Manufacturers' Association appointed a committee on Technical Investigation, which made a series of tests and published a report in 1901 ($1). One section of this report is devoted to a comparison of the wearing qualities of plain and repressed brick. The results of these tests show a decided advantage of the plain bricks over the repressed in that

their losses in the rattler are in the average over ten per cent. less. The advantage is greater in the case of end-cut than in the case of side-cut brick, although there are three cases out of eleven in which the repressed end-cut brick show a slight advantage over the plain end-cut, while there is only one instance in which the advantage is with the repressed side-cut brick.

The repressing is shown to reduce the co-efficient of thickness, as the length and breadth are expanded in the repress at the expense of the thickness, thus making the brick less able to endure the rattling test and presumably the street wear also. The results are shown to corroborate this reasoning and to such an extent as to overcome the known disadvantage of the plain bricks in the rattler on account of the knocking off of the sharp corners before the real abrasion test begins.

There is a rather inconclusive series of experiments on the effect of the flow of the clay in the repress, which tends to show the weakening effect of breaking the bond formed in the clay ribbon from which the bricks are cut.

The conclusions are that the superiority of the plain wire-cut product should be assumed until thorough tests have shown that this is not true with reference to the particular product of a particular factory.

In 1902, eleven city engineers in Iowa expressed preference for repressed brick; three for plain brick, and three had never used any but plain brick and had no experience on which to base an opinion.* No reasons were given for the preferences.

With modern methods of applying fillers so as to protect the corners of bricks and lugs on non-repressed bricks of proper form to insure filled joints, the principal reasons for using repressed blocks are removed and manufacturers and users may often save the expense of the repressing.

Books on Highways and Gypsum Manufacture.

Will you please inform me where I can secure a few good books on highway construction. Also give me some information regarding the establishing of a gypsum works, costs, etc.

L. A. B., Mangum, Okla.

Good books on highway construction are Byrne's "Highway Construction" ($5); Aitken's "Road Making and Maintenance" ($6), an English book; Morrison's "Highway Engineering" ($2.50), arranged in order of the preference of the writer. Baker's "Roads and Pavements" ($5) is also a good book if its arguments on earth roads are not taken to mean that really good roads are obtained by the methods proposed.

The manufacture of plaster from gypsum is fully described in Eckel's "Cements, Limes and Plasters" ($6) with data for estimates. MUNICIPAL ENGINEERING Co. can supply the books at the prices named.

Granulated Slag for Brick Pavement Foundation.

We are doing dry foundation paving with brick or block surface and sand filler. We find it desirable because of easy access for necessary improvements and repairs under the paving. We are ordinarily using gravel for foundation and have used coarse broken furnace slag, but it is not readily available on account of the newer system of granulating the slag which the furnaces are now following. It is suggested to use this granulated slag as a foundation. Can you inform me of any instances or endeavors for its use in such case either favorable or otherwise? The state aid pavement on East Palestine Road, shown in the fifth annual report of State Highway Department of our state, used the material for cushion coat under the brick, on concrete foundation. It has quite a marked cementing property when left standing in mass, and with abundant rolling I can see no reason why it could not be used, and there would be a desirable saving in cost.

C. E., East Palestine, O.

Can our readers give any information on this subject?

Would not the mixture of a proportion of quicklime with the granulated slag produce a still greater solidification of the foundation? Puzzolan cements are made by grinding together slag and lime to a fine powder and the simple mixture of the lime and slag without grinding should give opportunity for a certain amount of chemical combination which would make concrete of the foundation. The question then arises, whether the mixture of a proportion of larger aggregates, broken stone, gravel or crushed slag, not granulated, would not still further cheapen the foundation without weakening it, or possibly with the effect of strengthening it.

If our readers can not report experiments along this line it seems worth while to make them where the slag is available.

The objection made to plain broken stone or gravel for foundation is that it is impossible to make a foundation which will not settle unevenly under the influence of traffic, weather and subsurface conditions. The mortar is added so that the foundation under the brick will be strong enough to distribute the loads on the pavement over sufficient area to reduce the danger of unequal settlement as nearly to zero as possible. When the pavement is cut into for trenches the sub-foundation and the broken stone or gravel foundation can never be replaced exactly as before and the danger of unequal settlement is greatly increased. If concrete is used for a foundation, enough extra concrete can be used in replacing the foundation over the trench to insure that the repaired portion shall keep its place as well as the undisturbed portion. The necessity of frequent cuts in the pavement is therefore an argument in favor of a concrete foundation, and is emphatically not an argument for a foundation without cement. It is true that it costs less to make a cut and replace the pavement when the foundation is not concrete, but it is also true that the pavement cannot be

equally well replaced and that the pavement will deteriorate more rapidly and require replacement at an earlier day, so that even the argument of less cost of cutting the pavement and repairing it loses its force when all the cost is taken into consideration.

Paving Materials and Construction for Small Towns.

We desire to get some prices and information on paving materials and paving construction suitable for small towns. We desire to have some information on the matter that we may know what the difference is in different materials in cost, etc., and what will be the best for us to use. L. M., Lexington, Neb.

A good book from which much on this subject can be learned is Baker's "Roads and Pavements" ($5). Another good book which is brief and yet comprehensive is Judson's "City Roads and Pavements" ($2), which is prepared with special reference to the needs of small cities and towns.

There are many articles in MUNICIPAL ENGINEERING which will give information on the subject such as the following:

In vol. xxxviii: "Cost of Wooden Block Paving in Indianapolis," p. 42; "Narrowing Roadways in City Streets," p. 111.

In vol. xxxvii: "Materials for Tarring Roads," p. 18; "Street Width," p. 107; "German Artificial Stone Paving," p. 121; "The Cost of Adapting Macadam Roads to Automobile Traffic," p. 142; "Cost of Pavements," pp. 152, 177; "Sidewalk and Curb Design and Construction," p. 164; "Specifications for Cement and Stone Sidewalks, Curbs and Gutters," pp. 178, 206; "Concrete for Street Crossings," p. 180; "Automobile Proof Roads," p. 201; "Dust Abatement by Surface Applications," p. 236; "Specifications for Bituminous Macadam Pavements," p. 254, giving a number of references to previous articles on the same subject; "Indianapolis Specifications for Bituminous Macadam Pavement," p. 261; "Specifications for Making Macadam Road with Liquid Asphalt Binder," p. 274; "Tar in the Surface Treatment of Roads," p. 297; "Some Examples of Street Design," p. 307; "County Highways," p. 310; "Somerville's Experience with Tarvia," p. 346; "Three Years of Experience with Oiling Roads," p. 381.

In vol. xxxvi: "Efficiency of Concrete Pavements," p. 32, containing also references to prior articles on this form of street paving; "Amount of Pavement of Various Kinds," p. 117; "An Improved Form of Paving Brick," p. 130; "Construction of an Asphalt Street," p. 223; "Articles on Concrete Pavements," p. 245, giving references to articles on the Blome concrete pavement; "Cause and Prevention of Defects in Asphalt Pavements," p. 307; "Concrete Street Pavements," p. 312; "Experiments on Bituminized Macadam Pavements," p. 358; "Qualities of Paving Brick," p. 367; "Liquid Asphalt for Treating Macadam Roads," p. 396; "Road Preservation with Tarvia," p. 400.

These articles are distributed through all the numbers for 1909 and 1910, and there are many others in preceding volumes.

Methods of Assessing Cost of Sewers and Pavements.

I would be glad to see published in your Question Department a list of any articles which may have appeared in MUNICIPAL ENGINEERING within the past four or five years relating to special assessments for sewers and the name of any book or other publication of which you may have knowledge which covers this ground thoroughly.

The method in use here for many years past is to assess each sewer separately when it is built, assessing the cost of manholes, catch basins and sewers crossing street or alley intersections or opposite public property to the city, and the balance to property benefitted, the assessment district being fixed by the Common Council. The charter provides that each lot may be assessed for one main and one lateral sewer. Thus, when a main sewer is built all the property which will eventually be sewered to it is assesed to pay the ex-sewered to it is assessed to pay the ex-laterals are built each lateral is assessed to the property immediately benefitted.

One very serious objection to the method above outlined is that in many cases a main or lateral sewer is built for a few blocks only, but must be built at such depth and of such size that later, when the property further out shall become sufficiently developed to require it, it can be extended for a considerable distance. Thus the property near the sewer outlet is compelled to pay the expense of a large and deep sewer at a cost which is sometimes nearly equal to the value of the property; and later when the sewer is extended the property farther out is assessed for a small and shallow sewer at very light expense. The purchaser or owner of a lot for which a sewer has not been built does not know whether it will cost him one mill or one cent per square foot of property to get a sewer.

Our method of assessing the cost of pavements is the common one of assessing to abutting property the entire cost of the pavement opposite same, the city paying for street intersections. This is also unjust in many cases, though not so flagrantly so as the method of assessing sewers. A lot 25 by 100 feet on a corner may have 100 feet of pavement to pay for, while the lot next it is not assessed a cent.

Any information which you may be able to give me as to more equitable methods of special assessment will be greatly appreciated.

E. R. WHITMORE,
City Engineer, Port Huron, Mich.

The method of assessing cost of street intersections is discussed in the February number, vol. xxxviii, p. 110; also in vol. xxviii, p. 102.

The front foot rule of assessing cost of streets and sewers and the modifications that are permissible in some states to provide for the side streets running lengthwise of corner lots are discussed in vol. xxxvii, p. 327, and references are made to many court decisions on the subject. Its application in Knoxville is shown in vol. xxix, p. 434, and in Mankato, vol. xxviii, p. 242.

The methods in vogue in various states are stated briefly in vol. xxxv, p. 116; and the methods of making pavement assessments and collections in Detroit are stated in considerable detail in vol. xxxv, p. 367, and briefly for Grand Rapids in vol. xxix, p. 371.

The limitation of assesment to a proportion of the value of the property in St. Louis is shown in vol. xxix, p. 106, and in Louisville, in vol. xxviii, p. 241.

The theory of assessments for public improvements is discussed in articles in vols. vii, p. 82; xii, pp. 39, 154, 179; xiii, pp. 168, 372; xiv, pp. 38, 94; xv, pp. 215, 251; xvi, pp, 312, 313, 398; xviii, pp. 188, 247, 252; xx, pp. 149, 277, 354; xxi, p. 180; xxii, pp. 21, 157, 234; xxiv, p. 428; xxvi, p. 25. See also the article following.

A charter provision limiting the number of sewer assessments to two, one main and one local would work injustice on some property unless the main sewers were all construted and the assessments made for them at the same time. In large districts especially if they are not fully settled, this is practically impossible. Sometimes it is necessary, in order to treat all the property equitably, to make several assessments for main sewers. The writer knows of one piece of property which received four main sewer assessments and one local sewer assessment, simply because it was more convenient to make the contracts for construction in five sections. The sum total was no more, however, than it would have been if all the work had been let in one contract.

Mehtods of Assessments for Sewers.

I am at present attorney for village of Phoenix in the matter of installing a new sewer system. The village has filed a map and plan for complete sewer system for the village with the state department as required by our statute. The village board passed a resolution submitting to a voto of the taxpayers the question as to whether or not sewers should be built in Canal street in this village from Bridge street to Brandy brook, which proposition was carried and a general tax voted to pay for the construction. The general village law provides that sewers may be built wholly at the expense of the village or partly at the expense of the village and partly at the expense of property owners. This portion of the sewer so constructed has just been completed and paid for by the village. This is a trunk sewer running through the main street of the village, into which lateral sewers will empty. There are sewers in other streets which now are or will be connected with this main sewer. A committee was appointed to investigate and advise the village board whether or not parties wishing to use this new sewer or any village sewer should be charged a special rate or tax for the privilege of making connection. This committee has made a report to the board of trustees, a copy of which I enclose.

I have been asked to prepare an ordinance along the lines suggested by the committee. Will you please advise me what information you have with reference to matters of this kind and what authorities, if any, you can refer me to which will assist me in framing the proposed ordinance to meet the situation as presented in this village?

E. M. White,
Syracuse, N. Y.

The committee report referred to follows:

After an investigation covering the entire state of New York of the mode of assessing sewer assessments, we, the committee, appointed by your president, recommend that the following rules be observed in relation to parties using or proposing to use the new trunk sewer or any extensions or additions thereto:

1st. That an outlet tax of $15 be assessed against each residence or business place and $25 against each hotel, club room or manufactory employing twenty-five or more people. The object of this being to pay the increased cost of the main or trunk sewers over that of the smaller sized sewers which will be used in the residential portions of the village.

2nd. That each property draining into the aforesaid sewer or any connections therewith shall pay a frontage tax of thirty cents per lineal foot for each lineal foot said sewer or any connections therewith may extend along said property.

3rd. A tributary or connecting sewer for assessment purposes must have been constructed wholly or in part at the expense of the village and in such a manner that said sewer may, in the opinion of the engineer, properly become a part of the general sewer system in accordance with plans which have been adopted and approved.

4th. Any property abutting on sewers not built wholly or in part at the expense of said village and which connect directly or indirectly or which may hereafter connect with said trunk sewer, shall be assessed the outlet tax only, as prescribed in Section 1. But this privilege shall not render said property exempt from frontage tax if at any time a sewer shall be laid in conformity with the general sewer plan along said property.

5th. If, at any time, it shall be found for the interest of the village to use any sewer already constructed at private expense as a part of the general sewer system, the owner or owners of the property or properties for whose benefit said sewer was constructed, shall be recompensed for said sewer in a proper amount, but the property or properties thereafter shall be subject to the same assessments as any other like property or properties.

The committee report follows the principles generally accepted as proper in distributing sewer assessments. These principles are discussed in some detail in Municipal Engineering, vol xv, p. 215, and vol. xviii, p. 252. Other shorter articles may be interesting also.

A. In brief, the city at large is benefited by the sewers in that its sanitary condition is improved and the service attracts business and residents, or at least the absence of the sewers would repel prospective new citizens. The city at large should therefore pay a portion of the cost of the entire system. This portion may be represented by the cost of construction, maintenance and operation of a sewage purification plant in case one is necessary.

B. The presence of the sewer in the

street is a direct addition to the value of the property, which may be assumed to be proportioned to its area, especially if the sewers carry storm water as well as sewage. The property draining directly into the sewer should therefore pay a part in proportion to its area.

C. Usually the outlet sewers are constructed before the whole system is demanded. In such cases they must be made large enough so that they can carry the sewage from the branches when they are constructed. A portion of the cost of such outlet sewer should therefore be assessed on the whole district which will ultimately drain into it. This will be in proportion to the area also.

D. It is probably true that an improved property gets more benefit from the sewers than one which is not improved. Large users are certainly more benefited. Some portion of the cost should therefore be assessed in proportion to the value of the property or the amount of use made of the sewers or both.

The proportion of the cost to be assigned to each of these assessments is discussed to some extent in the articles referred to. It will vary as local circumstances vary to some extent.

Assuming that the assessments proposed in the committee report are in proper proportion, its first item provides for the classes of assessments in paragraphs C and D; that in the second item for B, using frontage instead of area, which is exactly correct if all lots are of the same depth; the third item seems to define the application of the assessments to fit a local condition; the fourth item provides directly for paragraph C in case of local sewers already constructed and is therefore correct; the adjustment for previous construction by private parties of sewers to be taken for public service should be made so that the private owners of the sewer will have paid their fair share of the cost and shall be reimbursed for any excess. Unfortunately such sewers are seldom in shape to adopt and must often be replaced, in which case the property may properly be required to pay its full share of the cost of the new sewer, the old sewer being a total loss to them. Sometimes a partial rebate may be equitable.

Among the articles of interest in considering this question are the following in MUNICIPAL ENGINEERING, not all of them being directly applicable to the details: vol. ix, p. 242; vol. xii, pp. 105, 154, 184, 372; vol. xiii, pp. 154, 372; vol. xiv, pp. 38, 313; vol. xv, pp. 215, 322; vol. xvii, pp. 32, 33, 97; vol. xviii, pp. 73, 247, 252; vol. xxi, pp. 82, 174; vol. xxiii, p. 168; vol. xxv, pp. 257, 380.

Concrete and Clay Products for Sewers.

I want information in regard to concrete sewers as compared with clay products. E. J. H., Chehalis, Wash.

Probably the fullest unbiassed discussions of the subject will be found in the volumes of MUNICIPAL ENGINEERING. The following articles give more or less information on the subject.

In vol. xxxvii; "Experience With Concrete Sewers," p. 34; "The Destruction of Concrete by Alkali," p. 112; "Concrete Sewer Pipe for Denver, Col.," p. 203; "Articles on Effects of Acids and Alkalies on Reinforced Concrete," p. 183; "Concrete and Brick Sewers," p. 253.

In vol. xxxvi: "Limestone in Concrete for Sewers," p. 36; "Durability of Concrete Sewers," p. 108; "National Hydraulic Cement Sewer," p. 182; "Concrete and Vitrified Pipe for Sewers," p. 379.

In vol. xxxv: "Concrete Sewer Pipe," p. 102; "Durability of Cement and Concrete in Sewers," p. 114; "Concrete and Brick for Sewers," p. 178; "Effect of Alkali Soils and Water on Concrete," p. 37; "Salt and Sea Water for Mixing Concrete," p. 381; "Effect of Salt and Alkali on Concrete," p. 385.

In vol. xxxiv: "Concrete Sewer Pipe," p. 358; "Phenomena of the Crushing of Sewer Conduits," p. 292.

In vol. xxxiii: "The Testing of Clay and Concrete Pipes," p. 240.

In vol. xxxii: "Effect of Frost on Concrete Pipe," pp. 247, 318; "Cement Sewer Pipe," p. 263.

In vol. xxxi: "The Physical Phenomena of the Penetration of Cement by Sea Salts," p. 54; "Effect of Sulphur in Concrete Aggregate," p. 447.

In vol. xxx: "Effect of Sewage on Concrete," p. 136; "The Decomposition of Cements in Sea Water," p. 441.

In vol. xxix: "Experiments on Steel-Concrete Pipes," p. 353.

In vol. xxviii: "Material for 36-Inch Sewer," p. 233.

In vol. xxvii: "Cement Sewer Pipe," p. 113.

In vol. xv: "Testing Sewer Pipes of Cement and Clay," p. 257.

Information About Cameron Patents on Sewage Purification Processes.

I shall be very glad if you can find for me any information of value in your files, concerning the Cameron patent, and especially concerning the instances of the prior art tending to show the non-patentability of the Cameron tank.

G. H. C., ———, Iowa.

The most logical explanation of the decision of the Federal Court in favor of the Cameron patents is that made by Prof. A. Marston in a paper on "Septic Tank Patents" before the League of American Municipalities, printed in MUNICIPAL ENGINEERING, vol. xxxv, p. 288. There in an editorial on "The Septic Tank Patent Litigation" on p. 311, which calls attention to a tank designed by the writer and built some years before the Cameron patents were applied for, and suggests the similarities and differences. There is also an editorial on "Septic Tank Patents Sustained" in vol. xxxiv, p. 94, describing the

tank in some detail. The main point in the decision is stated on p. 107 of the same number in an article entitled "Patents on Sewage Purification Process Sustained." Some correspondence on the question and editorial comment thereon will be found in vol. xxxiv, p. 303, in "The Septic Tank Question." References to many other articles on the process will be found in vol. xxxvi, p. 241, in an article giving "Information About Septic Tanks and Sedimentation of Sewage"; also in vol. xxxiii, p. 249, and vol. xxxi, p. 280.

Methods and Cost of Street Cleaning and Sprinkling.

Our city is contemplating the cleaning and sprinkling of its paved streets by contract, and I am seeking data of costs per unit of 1,000 yards per annum. Can you furnish me with a list of cities in Indiana doing this work by contract, together with the cost of same? I do not know of any small cities contracting such work.

W. S. F., City Engineer, ———, Ind.

Can our readers supply the desired information? That from small cities in other states will be acceptable for there are few such cities in Indiana which do street cleaning by contract and street sprinkling is usually done by private contract with property owners or tenants rather than by city contracts.

The city of Indianapolis has a street cleaning and sprinkling department which does the work for the entire city. Formerly it was done by contract and the figures of cost are given in an article in MUNICIPAL ENGINEERING, vol. xvi, p. 384, street cleaning being reported to cost from 19 cents up per 10,000 square feet each time for machine cleaning and street sprinkling $20 to $45 per 10,000 square feet of street per season. Figures of cost in several larger cities are also given.

A very interesting comparison of cost of cleaning streets under various conditions will be found in vol. xv, p. 40, showing the effect of the kind of pavement, its condition, amount of traffic, presence and condition of street car tracks and of pavement between tracks and character of population on the street. Thus wood, brick and asphalt pavements in good condition cost about the same to clean, and the cost increases as the condition becomes bad up to 40 per cent additional. A street with dense traffic costs up to 250 per cent more to clean than one of light traffic. Street car rails increase the cost 10 to 20 per cent. Blocks adjoining unpaved streets cost 100 per cent more than wholly paved districts. Estimates of cost in New York city are based on these percentages of increase and an observed cost for keeping clean asphalt pavement in good condition on a light traffic street of 69 cents per 1,000 square yards or 76 2-3 cents per 10,000 square feet per week.

In vol. v, p. 201, is an article comparing the cost of hand and machine sweeping and flushing in Indianapolis, giving details of labor cost and all items. For daily cleaning by hand with flushing once in two weeks, the cost is computed on the basis of about 50,000 square feet per man at $1.50 per day. The man's labor costs about $50.25 per 10,000 square feet for the season, from April 1 to November 1. Carting off the sweepings at 70½ cents a load cost $14.26. Hand tools, interest on plant and renewals cost 88 cents. Flushing 15 times at $20.75 each cost $11.79 and the profit to the contractor at 15 per cent was computed as $12.00. This makes the total cost for the season per 10,000 square feet $92.18, or for the 211 days the cost would be nearly 44 cents per 10,000 square feet for each cleaning, or a little over 38 cents not including the flushing. Machine cleaning was done by contract at that time for 35 cents per 10,000 square feet each sweeping, but this figure was reduced later to 19 cents and still later to 16 or 17 cents, not including flushing. It will be seen that the cost for each cleaning will not be appreciably increased if streets are not swept more than two or three times a week, provided the schedule is so arranged as to keep all the men and teams busy every day.

In vol. xxxi, p. 374, is an article on methods and cost of street cleaning which asserts that the author's observation is that cleaning by machine costs 82½ cents per 10,000 square feet, while cleaning by hand costs 27 cents and by flushing costs 35 cents. This in the face of the fact that many contracts have been let for machine sweeping for about one-fifth the cost above stated, and that even if the carting must be added to this latter cost it will still be scarcely more than one-fourth his figure. However, there is great variation in cost and on p. 437 of the same volume will be found a statement of cost of street cleaning in Cleveland by day labor which gives 99 cents per 10,000 square feet as the cost by machine sweepers and pick-up gangs, 47 cents by flushers and pick-up gangs, and 22 cents for "White Wings" or hand cleaning.

Some deductions from U. S. census reports are given in vol. xxx, p. 280. The cost varies widely in the cities of over 100,000 population. If anomalously small results in Kansas City and large results in Baltimore and St. Louis are omitted, the cost ranges from 19 cents per 10,000 square feet in Allegheny, Pa., to $1.71 in Providence, R. I. The average is 59 cents and Indianapolis reports 33 1-3 cents. Other tabular statements of cost will be found in vol. xxii, p. 207, and vol. xviii, p. 200.

In vol. xxxiii, p. 260, is an abstract from a report of street cleaning in Washington, D. C., which estimates the fair prices for hand cleaning to be 22.8 cents per 10,000 square feet, and for machine cleaning 25.3 cents. However, by assigning one man to some 30,000 square feet of street the cost of hand cleaning was kept down to 21 cents for 10,000 square feet, as reported in vol. xxxiv, p. 184.

Hartford, Conn., reports in vol. xxi, p. 41, that the pneumatic sweeper cleans for

25.8 cents per 10,000 square feet, the machine broom preceded by sprinkler for 33.8 cents, and the cost by hand is 55.9 cents.

In Indiana streets are swept by hand in Crawfordsville, Huntington, Lebanon, Lafayette, Ligonier and Martinsville. They are swept by machine in Bedford, Decatur, Kokomo and Richmond. Fort Wayne, Indianapolis, South Bend and Terre Haute use both hand and machine methods. Indianapolis, New Albany and Richmond use flushing methods also.

The latest book on the subject is Soper's "Modern Methods of Street Cleaning" ($3) which describes the methods in use in large foreign cities and in New York.

The State Board of Health of Ohio is making a study of street cleaning and garbage and refuse disposal and will report its findings from time to time, including methods and cost as well as the sanitary questions.

Garbage Collection in Small City.

I should like to get a little information on the collection of garbage and ashes in a small town, where the work has, of necessity, to be done with one man with a horse and cart and that one man the only fellow who is not afraid to tackle the dirty job, and usually he is fit for nothing else. Can it be put on a plane to induce better handling by more responsible men where the funds for that purpose are necessarily limited?

H., Mayor, ———, Ohio.

As stated in a brief article on this subject in MUNICIPAL ENGINEERING, vol. xxxvii, p. 36, little has been done in reducing the methods of garbage collection and disposal to standards in small cities. The article contains references to good articles in previous volumes, for the subject has been discussed frequently. The series of articles on English methods of "Town Scavenging and Refuse Disposal" which is now in progress will give some valuable pointers. So will the other articles which appear in this and following numbers.

The point to emphasize is that good work can not be expected unless the proper compensation is given. The small city requires so small a force and it is so difficult to bring the citizens to proper standards of preparation of material for removal that it is not easy to find a competent man who will be willing to do the work.

A new garbage crematory suitable for small cities is described in the January number, vol. xxxviii, p. 63. This need be operated only when there is enough garbage on hand to keep it busy a few hours, and if located and designed so that there will be no nuisance from the storage of garbage can be used by the smallest towns.

One suggestion is that the city council or town board require every householder to possess himself of two garbage cans, with covers, of prescribed size and design. One of these will be carried away by the garbage collector and taken to the destructor plant. When emptied it will be carried back and the filled can taken away in its place. In a small city or town this plan should work well. It would reduce the objectionable features of garbage collection to a minimum and would provide a storage for the garbage during the hours it must wait for the whole collection to be made and the destructor started. The labor of cleaning and returning the cans would be well repaid by these advantages.

The principal difficulty would be to educate the people to the necessities of the case and to require the supply of the cans and their proper use. This can be done by judicious action of the Board of Health.

With the destructor it would be possible to carry away in the same receptacle all the waste of the houses, garbage, ashes and combustible refuse, and, while there would be considerable variations, the condition of the collections as regards moisture would generally be favorable to ready destruction.

Will our readers add their contributions to the discussion of this subject? It needs far more attention than it has heretofore received, especially in the smaller places. As shown in Mr. Morse's paper before the American Society of Municipal Improvements the larger cities have made material advances in recent years.

Apparatus for Testing Cement.

Will you kindly tell me where I can procure a Vicat needle, LeChatelier's apparatus for testing for specific gravity and sieves Nos. 100 and 200?

C. A. M., ———, Wash.

Names of manufacturers of such apparatus will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Cement Testing Machinery" and "Testing Machinery."

Relative Cost of Municipal Work Done by Day Labor and By Contract—A Correction.

The writer's attention has been drawn to a statement made on page 83 of the February issue of the MUNICIPAL ENGINEERING under the caption "Statistics concerning the day laborer forces of the sewer departments of various cities," the same being a part of an article by Harrison P. Eddy of Boston, entitled "Relative Cost of Municipal Work Done by Day Labor and by Contract." In the column headed "Saturday Half Holidays" he gives Holyoke as allowing the holiday. This statement is an error or misconception of facts. Holyoke does not allow its laborers a half holiday on Saturday with pay. In the winter time the men work Saturday afternoons the same as any other afternoon; in the summer time the men do not work on Saturday afternoons, but they work forty-eight hours during the week, and the time is so made up that they stop work at 12 or 12:30 o'clock

Saturday noons. This arrangement is allowed by the Massachusetts state laws.

The writer is of the opinion that nearly all of the information contained in the article was gathered in late 1907 or early 1908 and the conditions existing at that time may not have been the same as exist today.

Had the reference regarding the pay for Saturday half holiday been made which is made in the case of some other cities the table in question would have been nearer correct.

I should like to inquire the meaning of the heading of the two columns, the first reading "Rate of Pay Nominal (Per Hour) Cents" and the next column reading "Rate of Pay Actual (Per Hour) Cents."

OSCAR C. TERRY,
Asst. Clerk, Board of Public Works,
Holyoke, Mass.

The table referred to was taken by Mr. Eddy from a table in the report of Metcalf and Eddy to the Boston Finance Commission, and the latter table is in part correct as it has a notation to the effect that Holyoke laborers work 48 hours a week, which time is so distributed that they have a Saturday half-holiday, but is incorrect in that it does not distinguish between winter and summer. In making a transcript for the article in the February number of MUNICIPAL ENGINEERING this notation seems to have been omitted, as it does not appear in the blue print of the table used as copy for the article.

The fourth column of Table 5 gives the quoted rate of pay, being the daily pay divided by the nominal length of the day in hours, given in the third column. This is termed the nominal rate of pay. The actual rate of pay, given in the fifth column is obtained by dividing the pay for a week by the number of hours of actual labor, after allowance has been made for half-holidays or other customs whereby laborers are paid for time when they are not actually at work. It will be observed that only those cities named in the table which allow Saturday half-holidays with pay show any differences between the figures in the two columns.

A communication from Mr. Terry in the department "From Workers in the Field" gives further details about the handling of the labor question in Holyoke.

Paints and Waterproofing for Concrete.

We would like to get hold of a paint for painting cement floors; also a water proofing to use in reservoirs that can be applied with a brush while the walls are damp. Can you give us reference to any firms handling this class of goods that are strictly all right?

A., Lincoln, Neb.

Can our readers give any information on this line? With reference to the floor paint there should be more information regarding the purpose of the paint and the use to which the floor is to be put. The writer knows of no waterproofing which can be successfully used on reservoir walls in the manner described.

Ordinance Governing Census of City.

Can you supply a form of a proper ordinance providing for taking the census of a city of the fourth class for the purpose of organizing as a city of the third class?

R. H. D., ———, Mo.

Can any of our Missouri readers supply the information desired? This seems to be a question peculiar to that state.

A brief sketch of the terms of such an ordinance will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 110.

Examinations for City Engineer.

I am advised that you have from time to time published lists of questions presented to applicants for position as city engineer. I would like to see questions submitted to engineers for cities of population from 10,000 to 30,000.

R. A. W., Batavia, N. Y.

Unfortunately there is nowhere in this country any provision for the examination of candidates for city engineer in cities of the size mentioned, so that no such questions have ever been prepared. There is a "Manual of Civil Service Examinations for Engineering Positions in New York City" ($6), but these examinations are confined to subordinate positions in certain departments in that city. The city of Chicago also has such examinations and probably sample sets of questions can be obtained by applying to the Civil Service Commission. There are a few other cities and a few states which have civil service examinations, but they are not numerous in this country and none are known to the writer in cities of 10,000 to 30,000 population. It is not uncommon in Great Britain and Ireland to hold examinations for positions corresponding to that of city engineer, even in cities or boroughs as small as those mentioned, but the duties and the conditions are so different that such questions would be of little value except as examples of the practice in other countries.

MUNICIPAL ENGINEERING would be more than pleased to see some better method of selecting city engineers, and to have the opportunity to publish questions actually used in the examinations of candidates for such positions.

Oil for Fuel Under Boilers.

Can you inform me through the columns of your valuable magazine where I can obtain reliable information about the use of crude oil for fuel under boilers for power purposes?

Would like to know what style or construction of burner to use, and how boilers now used with coal for fuel can be adapted to oil.

W. C. B., Engineer, ———, Kan.

The principal books on this subject are Booth's "Liquid Fuel and Its Combustion" ($8); North's "Oil Fuel, Its Supply, Composition and Application" ($1.75); and Lewes' "Liquid and Gaseous Fuels" ($2).

Boyd's "Petroleum, Its Development

and Uses" ($1) and Phillips' "Fuels, Solid, Liquid and Gaseous" (80 cents) may contain something of value in this connection.

English books on the subject are Hodgett's "Liquid Fuel" ($2.50); Clark and Williams' "Fuel" ($1.50); and Mills and Rowan's "Fuel and Its Applications" ($5).

Where to Take an Examination.

Will you please let me know where would be the best place to write to find out where I could undergo an examination for inspector of stone mason work?

F. M., Pawling, N. Y.

For service in New York City address the Municipal Civil Service Commission, 299 Broadway, New York.

For service with New York State address the New York State Civil Service Commission, Albany, N. Y.

For service with the United States address the United States Civil Service Commission, Washington, D. C.

For service with any city having civil service examinations address the mayor with the request that he refer it to the proper department.

Plans for Municipal Buildings.

Will you kindly furnish me with the names of architects who issue books of plans for city halls and churches.

A., ———, N. D.

The only books of plans for city buildings and churches known to the writer are Crane's "English Country Churches" ($10 in portfolio) and "Church Building" ($2.50); Clinch's "Old English Churches" ($2.60); Kidder's "Churches and Chapels" ($3); Kramer's "The What, How and Why of Church Building" (75 cents); Valk's "Modern Church Edifice and Its Plan" ($1); Bicknell's "Public Buildings" ($2.50); Palliser's "Court Houses, Village, Town and City Halls, Etc." ($2); Keith's "Architectural Studies, Churches" ($2). There are also portfolios and books of early churches and cathedrals.

Reference may be made to the "Business Directory" under the heading "Architects," published in each number of MUNICIPAL ENGINEERING for names of men who will make plans for such buildings.

Can our readers refer us to other publications of the desired nature?

Officers of State Municipal Leagues.

I am desirous of securing copies of constitutions and by-laws of Municipal Leagues or Mayors' Associations of one or more States, also copies of proceedings of their conventions in full. Can you advise where I can secure?

P. BENTZ, Acting Secretary,
State League of Municipalities of Utah.

Address the following officers of such organizations for the desired information and documents:

F. C. Highsmith, Mineral Wells, president of the Association of Texas Mayors.

Harry L. Lusk, New Castle, Pa., for the League of Cities of the Third Class of Pennsylvania.

John MacVicar, Des Moines, Ia., secretary of the League of American Municipalities.

Mayor of LaSalle for Illinois Mayors' Association.

Mayor of Atlantic City, N. J., for League of New Jersey Seashore Municipalities.

Frank G. Pierce, Marshalltown, secretary of the League of Iowa Municipalities.

C. W. Merrill, Richmond, secretary of Municipal League of Indiana.

Lee Combs, Valley City, secretary Municipal League of North Dakota.

Rhodes Brown, Columbus, president of League of Georgia Municipalities.

Lawton F. Hemans, Mason, president of League of Michigan Municipalities.

A. C. Crowder, Mississippi League of Municipalities.

Adolph Roeder, Orange, president of New Jersey State Civic Federation.

W. M. Teague, Montgomery, for Municipal League of Alabama.

Books on Glass Making.

Could you inform me where I could obtain a book on the manufacture and more especially the annealing of glass?

T. J. B., Oroville, Cal.

Rosenhain's "Glass Manufacture" ($2) is a hand-book on the subject. Powell, Chance and Harris's "Principles of Glass Making" ($1) is an English hand-book. "Recipes for Flint Glass Making" ($4.50) may be of interest.

Books for City Attorneys—Who Pays Expense of Quarantine?

What single work do you consider best guide for town attorney? Will you please give me your opinion on the following. It became necessary a short time ago for the local board of health to quarantine several houses in our town to prevent the spread of smallpox. Many of those quarantined were laboring men, dependent upon their labor entirely for their and their families' support. When quarantined they were deprived of their support and became dependent. Has the town board a right under present law to furnish food, board, fuel, or any other necessary commodities for the support of the parties quarantined, or must the township trustee take care of the parties?

H., City Attorney, ———, Ind.

The best work for city attorneys, especially in Indiana, is Thornton on Cities and Towns, which was prepared by an Indiana lawyer, and so gives an emphasis to Indiana conditions. Other good books are Dillon on Municipal Corporations, 2 volumes, and Elliott on Municipal Corporations, a small book.

Sec. 7, of chap. 144 of the Laws of 1909, Indiana, seems to make it the duty of the town board acting as a board of health to pay all the expenses of a quarantine, and the subsistence in every way of those quarantined, if they are prevented from pursuing their occupations is evidently one of the expenses of the quarantine.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Filtering Intake for Water Supply from River.

In relation to "Filtering Intake for Water Supply from River" by A. S., page 112, February issue. The plan proposed, if adopted, will not be a success. The area proposed is not sufficient to give the required amount of water, and if they try back-flushing with 200 pounds of water pressure, they will certainly clean everything.

The increase in suction lift due to this method of getting water will prevent them from getting a sufficient supply during the low water season and if they mix the raw river water with the infiltered water they will get a combination that will give them trouble.

The results obtained from an infiltering system, when properly installed, are superior to any other method of purification in low cost of installation and operation and high efficiency, but the designer must be familiar with the conditions, or the result will be a failure, as indicated by past experience.

We have in use a method similar to the one described which was installed under patents granted L. E. Smith of Charleston, W. Va.

ASA WILLIAMS,
Chief Engineer,
Owensboro, Ky., Water Works Co.

The above letter was submitted to A. S., who responds as follows:

I thank you very much for your attention in regard to arriving at proper decision to install correct filters here and to give me Mr. Williams's opinion. Mr. Martin, former superintendent of Owensboro water works, an intimate friend of mine, has been in correspondence with me since some time about this question, and he too advises large filter area, larger distance from shell to shell. But they and all others who put out natural filters never excavated river to create proper material for the shells to draw from. I claim that 3 feet of gravel at the bottom of shells, then 5 feet of sand and 3 feet more gravel on top even with river bottom will filter water both ways, from top gravel stratum as well as from bottom gravel stratum, making it a natural as well as artificial filter body.

Regarding the flushing and exciting the filter gravel-sand body, it never was intended to open an 18-inch valve under 200 pounds pressure wide open and make trouble. The way I am flushing now and for twenty-eight years, I open an 8-inch flushing valve in pump well and let her go —through strainer openings—but in the filter-suction only an opening of valve gate not over 4-inch or one-half of 8-inch diameter would be used for flushing purposes, and the water, by the time it would rush through 450 feet of 18-inch pipe and then divide itself in ten shells, would not be able to make much trouble, would it? So there need be no fear as to that.

Now, then, if I have very ample filter area and a surplus, the filtered water never can be lower in suction-filter line than the river level, hence no use running old suction. But if I had to do so, from some cause or necessity, I can flush every foot of fourteen miles of main, when filtered water is again pumped. And before pumping filtered water again, after using raw water, I can empty the basins completely without trouble, flush out raw water at eight dead-end flushing stations which I put in to blow out mud. By 1911 I will have every iota of investigation sifted.

By the way, when the Ohio river is extremely low, to make 25-foot lift from low water to discharge valves of pumps, the water then is hard, all spring water, clear as crystal, and the filtered water during the year must be the same hard water, so how could the combination injure the quality? I am sure of this, have watched it for years; at that time both waters will be alike, and if this low water quality ever had made a bad combination heretofore, mixing with rising soft water when rain comes, it would have been found injurious in twenty-eight years. The hard water every year must mix with the soft water when river rises after rains.

A. S., ——, Ky.

Asphalt Repairs in Marion, Ind., in 1909.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I herewith send data on our asphalt repair work for the season of 1909. While not quite satisfied with the showing made, it may be of interest to those having this kind of work to do.

For data on plant equipment I would refer you to former data in MUNICIPAL ENGINEERING, vol. xxxvi, p. 182.

Before beginning 1909 work I had a new bottom put in the Hooke pan, also enlarging same, and instead of turning out 14 2-3 cu. ft. of loose mixture, as in season 1908, we turned out 16 5-6 cu. ft. of loose mixture per batch. This should have increased our output as well as decreasing labor expense, but instead of using the "Acme" asphalt (as in season 1908) we used a different brand of cement which took about 25 per cent. more asphalt for the same amount of mixture, not only adding to the material expense, but it took quite considerable longer time to mix a batch than had we used the "Acme" asphalt.

Total cost of labor and material, $1,486.07.

You will observe that we used stone dust as a filler, whereas in 1908 we used Portland cement as a filler. This should reduce material expense. We used Portland cement as top covering only. You will observe that our fuel did not cost as much as in 1908, yet, owing to the longer time required in mixing a batch, it took more fuel per batch. The same number of men were employed, there being but one new man as an exchange from the gang of 1908. The men were not as energetic in trying to push the work as they were in 1908, which caused the labor expense to increase somewhat. Our work consisted of smaller patches in general than in season of 1908. This caused the labor expense to increase, as when many small patches were made in succession the gang at the plant would be compelled to hold back their work waiting on the men on the street to prepare places to receive material. The accompanying table gives the results in detail.

T. E. PETRIE,
City Engineer and Street Supt.,
Marion, Ind.

This table includes entire season's work.

Total cost of asphalt plant, $625.

Depreciation on plant at 10 per cent. per annum, $62.50.

Interest on plant investment at 6 per cent. per annum, $37.38, or $1.15 per day.

Cost per square yard, average depth 2 inches, $1.024.

Cost per cubic foot, 52½ cents.

Season 1909.	No. Square Yards Laid.	Cost of Labor at 20 and 25 Cents.	Cost of Asphalt Including Freight at $28.714 per Ton.	Cost of Sand at Plant at $0.75 per Cubic Yard.	Cost of Cement at $1.40 per Barrel.	Cost of Stone Dust Including Freight and Drayage at $3.52 per Ton.	Cost of Fuel at $4.50 per Cord.	Cost of Cartage on 20 Tons Asphalt.	No. of Cubic Feet.
July 26	32.8	$18.07	$10.11	$1.35	$0.12	$0.66	$1.55	$0.12	50.5
27	56.2	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
28	74.0	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
a29	10.8	16.56	16.85	2.25	0.20	1.10	2.25	0.20	84.2
30	53.3	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
31	40.0	17.02	16.85	2.25	0.20	1.10	2.25	0.20	84.2
August 2	40.4	18.55	20.22	2.70	0.24	1.32	2.70	0.24	101.0
3	56.8	19.55	20.22	2.70	0.24	1.32	2.70	0.24	101.0
5	67.6	20.01	20.22	2.70	0.24	1.32	2.70	0.24	101.0
4	59.3	20.01	20.22	2.70	0.24	1.32	2.70	0.24	101.0
b6	8.3	15.27	3.37	0.45	0.04	0.22	0.45	0.04	16.8
7	43.2	18.72	16.85	2.25	0.20	1.10	2.25	0.20	84.2
9	49.1	20.15	16.85	2.25	0.20	1.10	2.25	0.20	84.2
10	66.8	20.15	23.59	3.15	0.28	1.54	3.15	0.28	117.8
11	55.7	20.47	20.22	2.70	0.24	1.32	2.70	0.24	101.0
12	40.1	16.38	13.48	1.80	0.16	0.88	1.80	0.16	67.3
14	39.2	16.66	16.85	2.25	0.20	1.10	2.25	0.20	84.2
16	42.2	20.15	16.85	2.25	0.20	1.10	2.25	0.20	84.2
17	56.9	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
18	54.2	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
19	56.9	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
20	56.2	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
c21	29.7	15.22	13.48	1.80	0.16	0.88	1.80	0.16	67.3
b23	16.5	20.02	6.74	0.90	0.08	0.44	0.90	0.08	33.7
24	31.0	19.42	13.48	1.80	0.16	0.88	1.80	0.16	67.3
25	68.1	20.01	16.85	2.25	0.20	1.10	2.25	0.20	84.2
26	23.2	20.01	16.85	2.25	0.20	1.10	2.25	0.20	84.2
27	33.2	16.72	13.48	1.80	0.16	0.88	1.80	0.16	67.3
28	47.9	19.40	16.85	2.25	0.20	1.10	2.25	0.20	84.2
30	39.1	19.61	20.22	2.70	0.24	1.32	2.70	0.24	101.0
31	51.6	19.53	20.22	2.70	0.24	1.32	2.70	0.24	101.0
September .. 1	40.1	20.91	16.85	2.25	0.20	1.10	2.25	0.20	84.2
c2	11.1	7.04	6.74	0.90	0.08	0.44	0.90	0.08	33.7
No. days...33	1,451.5	$618.43	$566.18	75.60	$6.72	$36.96	$75.60	$6.72	2,282.1

a Rained, burned asphalt. b Moved plant. c Finished street.

Preserving the Trees.

That the cities and towns of Pennsylvania are awakening to the importance of shade tree commissions and the proper care of shade trees on the highways of the borough is apparent to any one who keeps in touch with municipal developments in the various cities of the commonwealth. One of the first in Western Pennsylvania

to take up the work of municipal improvement in a systematic manner was the borough of East Washington, a residence suburb adjoining Washington, Pa. Burgess W. P. Warne has been instrumental in having the ordinance passed through the East Washington council which provides for a commission of three men to be known as the shade tree commission, to have full control and care of the shade trees on the thoroughfares of the borough.

This commission has exclusive custody and control, power to plant, set out, remove, protect and care for all trees on the highways. D. W. Myers, J. W. Emery and W. R. McIlvaine, all public-spirited citizens, who will serve without compensation, have been named on the commission and assumed their duties on the first day of February.

The actions taken by the burgess and town council are being met by the approval of the citizens, and it is evident that all possible means will be given to make East Washington one of the prettiest boroughs of homes in that part of the country.

Defects in Springfield Water Works.

In an address before the Chamber of Commerce of Springfield, Ill., Willis J. Spaulding, the superintendent of the water work, gave a strong presentation of the defects in plant and in management which he has found, from which the following extracts are taken. Many cities are laboring under the same difficulties, either through ignorance or negligence, and Mr. Spaulding's strictures will apply to them as well as to Springfield.

The City of Springfield owns a water works system worth perhaps one and one-half million dollars, involving the welfare of 60,000 people and immense real estate values. I am proud that the city owns it. I believe the city ought to own it, and I have faith that the city can manage it. It is my ambition to vindicate and prove that faith.

Early last summer we discovered a large quantity of water from the river was finding its way directly into the galleries. We set to work immediately and repaired this leak. We then had good water for about two weeks, when the supply from the galleries became insufficient, making it necessary to open the emergency intakes, which of course polluted the whole supply, making the water off color and also unwholesome.

As near as could be estimated the supply from the galleries was about one million gallons per day short of requirements. How to make good this shortage was our next problem. We hope to accomplish this by extension of the galleries, which has already been started.

Our income is sufficient to maintain a plant as fine as any in the State, but the funds have not been spent in building up the plant, but are continually diverted from their proper use. Last year about this time $37,000 was diverted from the water fund to the general fund, leaving the department $42,800 in debt. This was illegal, but nevertheless it was done. The pumps and other equipment at the river were not only found to be badly run down, but were in a dangerous condition. We have no storage reservoir to fall back on, but receive our water supply directly from the pumps, so that it is necessary to keep going twenty-four hours every day.

Under such circumstances, ordinary prudence demands that all pumping equipment be in duplicate at least, and that it be the best that money can buy. When I took charge, the city was depending on one pump which had been in continuous service for about ten years. It was known to be badly in need of repairs, but it could not be relieved from duty long enough to permit overhauling. It stopped going one day during the month of July, and the plant was tied up except for one small pump, which was entirely inadequate. The city was in danger from fire, and all water users were in more or less trouble. In an adjoining building was an old pump, installed in 1876, which had not been in use for many years. To avoid another such calamity we took this apart and put it in good repair. We had to do this in direct violation of the orders of the council. This gave us two small pumps available for service which would carry the city in case of emergency. Having these pumps in reserve, we next proceeded to overhaul the big pump.

After taking it apart a remarkable situation was found in one of the steam cylinders. The main valve in this cylinder was placed in position backwards, so that, instead of opening and closing as it was designed to, it remained open continuously, letting the steam pass by without control, making it ineffective and useless. This was adjusted and all worn and weak parts were replaced, and when the work was completed, which required about thirty days, we had a pump that was practically as good as new in every way.

To compare the efficiency of this pump after being repaired with what it had been, we weighed the coal and found that where we formerly burned an average of nineteen tons per day we are now burning about thirteen tons, thus showing a saving of six tons of coal per day, equivalent to $7.80, or about $2,800 per year. However, a portion of this saving is due to the removal of scales from boilers and other boiler room economies.

The new contract made by our present mayor shows a large saving in the purchase price of the coal as compared with what was formerly paid. These savings will reduce our coal bill about $4,500 annually, or about 45 per cent., and I am quite sure that further economies in the use of fuel are possible.

We now have three pumps in good repair, ready for service, with a combined capacity of fifteen million gallons daily.

We spend about $40,000 per year on our

distribution system, which employs anywhere from ten to fifty men laying new mains, keeping services, hydrants and mains in order, etc. We are improving the efficiency in this division by the introduction of modern business methods. I am absolutely certain that the water department can lay its mains, all things considered, as cheap as any responsible contractors will do it, and do the work better, notwithstanding that our men work eight hours, while theirs work nine or ten.

Our average daily pumpage is five million gallons. About one-half million gallons are free and about two millions are wasted, which at the present price we get for water is worth about $250 per day, or nearly $100,000 annually. Thus, of the five million gallons pumped, only two and one-half million gallons are legitimately used and paid for. So, in fact, we have the water supply already, if we could keep it from slipping away from us.

By metering all services this waste water (or most of it) can be saved and turned into pay water, supplying the consumers. As fast as this waste is put to earning revenue it will relieve the present water consumers of a burden they are now carrying, making it possible to make a general reduction in rates of fully one-third.

One objection made to meters is that sewers will become clogged and sanitation bad. I questioned thirty or more metered cities on this point. None of them experiance any such difficulty.

Where meters are in use, each consumer will watch his plumbing and keep it in repair. As an example, a consumer some time ago complained that there was no pressure, and that there had been none for a year or more. On examination we found that nearly all the water from his service was running into the sewer on account of bad plumbing, leaving so little that there was no pressure to be had. Had this service been metered, it would have shown a waste of about $15 per month, or $180 per year, and would have been promptly repaired. The department was receiving about $12 per year, showing a loss of $168.

If our present wasteful methods are still to be pursued, large development projects should be started at once. The mains from the works to the city are inadequate, resulting in a loss of pressure which is becoming serious. We are sometimes unable to deliver water to the third floor of ordinary buildings. At least one large pump must be added and provisions must be made for a large increase in the supply from the galleries or other source. This means an expenditure of from two to three hundred thousand dollars. For the water department to enlarge its plant and increase supplies, without conserving what it already has, is misusing good money by adding waste to waste. By adoption of meters, we can actually reduce the daily pumpage in the face of an increasing population, and put off the greater part of the investment referred to until Springfield has passed 100,000 in population.

I now wish to call your attention to some gross inequalities in the rates charged for water. Our rates are based on quantity consumed, beginning at 25 cents per 1,000 gallons to the small consumer, and grading down to 6 cents per 1,000 gallons to the largest consumer. Thus the small consumer pays 400 per cent. more than the large consumer.

It is common in selling goods to make a price reduction in proportion to quantity. However, such discounts rarely exceed 50 per cent., except where prices are arbitrarily fixed by public service corporations, or where monopoly is unrestrained. When one consumer pays 6 cents and the other pays 25 cents for 1,000 gallons of water, the idea would naturally suggest itself that the department must be either losing money at 6 cents or making an exorbitant profit at 25 cents. Both are true.

It costs at least 8¼ cents per 1,000 gallons to meet fixed charges and other expenses of the water department, or practically 2¼ cents more than the present minimum. At the same time, 25 cents per 1,000 is in most cases unfairly high, and is made necessary because some consumers pay too little.

Through our water rates, as at present applied, we are losing about $5,000 per year on a few large consumers (eleven in all) and are charging the small consumers enough extra to make good the loss. That is to say, we are arbitrarily taking that amount of money from one class of customers and giving it to another class.

It will be argued that most of the water works expense consists in fixed charges, and therefore it is an advantage to the department to sell water to some consumers at a price that will cover a portion of these fixed charges even though too low to cover all. This argument can hold good only where it can be shown either that we have the water in surplus, that any higher price would drive away consumers, or that it would discourage industry. Now, we have no surplus of water available at the present time.

Eight cents per 1,000 gallons is not a high price for water, and will not lose the department any business. It will not discourage factories, because none of them get the 6-cent rate; most of the factories pay double that amount. Those who regularly get the 6-cent rate, or a rate under 8 cents per 1,000 gallons, are five steam railway companies, the Utilities Company, the State capitol, two ice plants, the brewery and one hotel. I do not think any of these would consider themselves as infant industries, which the other water consumers are called upon to assist through charity to the extent of $5,000 per year.

While it is true there are some cities where the minimum charge is 6 cents or

even less, the rate in these cities may be sufficient on account of the cost of production being less. In 375 cities the average minimum is 9.2 cents per 1,000 gallons. In 150 cities, nearly the size of Springfield, and larger, the average minimum is 8.28 cents. These cities have not been selected, but are taken at random. In Chicago the rate was recently raised from 5 to 7 cents because it was found the water department was losing money. The minimum at St. Louis is 8 cents; Minneapolis, 8 cents; Cincinnati, 10 cents; Rochester, N. Y., 14 cents; New York City, 13.3 cents: Boston, 10.6 cents. In 1902 Daniel W. Mead, acting as consulting engineer, advised that our lowest meter rate should not be less than 8 cents per 1,000 gallons, as conditions here would not warrant it.

I believe that the minimum rate should be made 8 cents instead of 6 cents, and that a sweeping reduction of 10 per cent. should be made on all meter rates, conditioned on the bills being paid on or before the 20th of the month in which they are due, but the net sum received by the department after deducting the 10 per cent. should in no case be les sthan 8 cents per 1,000 gallons.

The Engineer as Municipal Reformer.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The value of the engineer as a municipal reformer is getting a somewhat amusing, though also an instructive illustration at the hands of the new mayor of Boston. Mayor Fitzgerald captured the administration of the "reformed" city charter from the reformers, and he now takes an unusual course of action by by putting in force one of the recommendations of the late Finance Commission, which he himself appointed two years ago, and of whose criticism he was the most conspicuous target. Metcalf and Eddy, consulting engineers to the Finance Commission, in one of their many reports took up the waste of water by the city departments, which were not charged for their use of water. Mayor Fitzgerald, in his order just issued, quotes their figures as to the waste, and the resulting deficit to the Water Department, and requires each department hereafter to pay for the water it uses. Metcalf and Eddy estimated that the actual waste of water reached an annual total of $25,000, while the loss of revenue to the Water Department was set at over $200,000. Mayor Fitzgerald quotes the engineers' figures and adopts their recommendation. The value of expert investigation of city affairs could hardly be better demonstrated. S., Boston, Mass.

Cost of Operating San Francisco's Asphalt Plant.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Enclosed you will find cost of operating our municipal asphalt plant from March, 1909, the date it began operations, to January 1, 1910.

LEONARD S. LEARY, Chief Bookkeeper
of Board of Public Works,
San Francisco, Cal.

Similar work done on Market street by private contract cost 16½ cents per square foot. The saving made by the plant is therefore $97,558 during the time covered by the report.

COST OF OPERATING SAN FRANCISCO'S MUNICIPAL ASPHALT PLANT FROM MARCH 1, 1909, TO JANUARY 1, 1910.

1909	Cubic feet Binder	Cubic feet wearing surface	Cost of Material in Binder	Cost of Material in wearing surface	Total cost of Material	Cost of labor at Plant	Expense at Plant	Total Cost of Material labor at Plant	Total cost labor, teaming etc on Street	Total Cost of Laying Pavement	Square Feet of Pavement Laid	Cost per Square foot laid
Mch	11702	9054	$1755 30	$2878 20	$ 4633 50	$1367 55		$6001 05	$3241 62	$9242 67	59436	0 1552
Apl	20234	20620	3065 18	5959 30	9024 48	1643 51	$ 336 00	11003 99	5451 63	16455 62	143473	0 1147
May	17912	26712	2686 88	7270 56	9957 44	1942 35	584 69	12484 48	6327 22	18811 70	197861	0 0951
June	23528	25428	3528 80	6857 28	10386 08	2089 76	1041 21	13517 05	5524 88	19041 93	192926	0 0987
July	28088	26096	3847 29	7349 44	11196 73	2288 86	775 31	14260 90	6636 76	20897 66	191884	0 1089
Aug	25288	26848	3463 82	6980 48	10444 30	2309 41	1407 60	14161 31	7138 43	21299 74	205413	0 1037
Sept	24486	24992	3354 53	6494 87	9849 40	1980 27	1535 58	13365 25	6688 45	19853 70	200400	0 0991
Oct	24720	24532	3386 67	6801 16	10187 83	2072 85	1865 31	14125 99	7058 22	21184 21	216597	0 0987
Nov	20760	15648	2844 09	4087 08	6931 17	1955 94	2036 58	10914 09	4879 56	15793 65	126217	0 1243
Dec	16800	15608	2301 59	4076 88	6378 47	1809 36	1581 43	9769 26	4007 31	13776 57	125865	0 1094
	215518	216598	$30[illegible]	$[illegible]	$[illegible]	$ 9459 96	$10953 51	$119403 31	$56934 08	$176337 45	1660072	0 10623

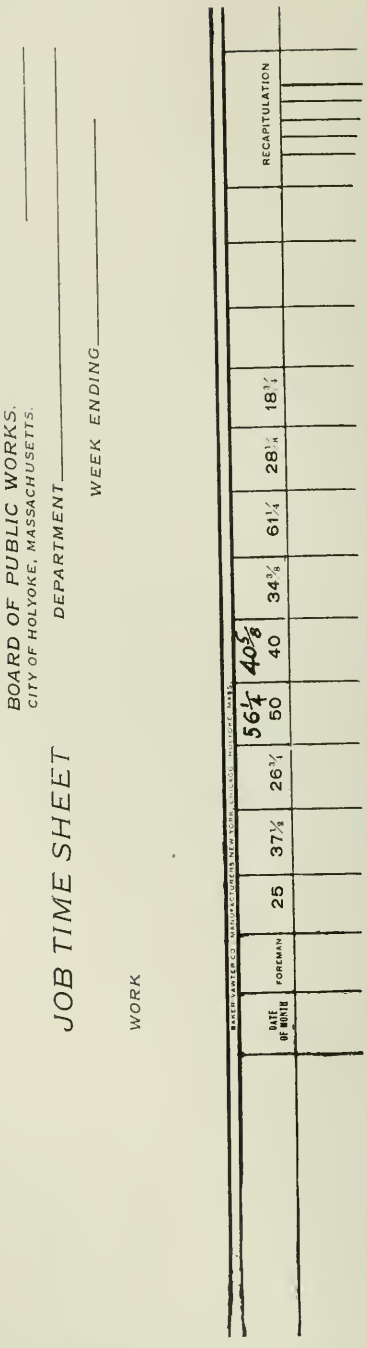
Handling Day Labor in Holyoke, Mass.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The methods used by this city in handling day labor do not differ materially from the methods employed by contractors in so far as the writer is aware.

All of our outdoor work is under the direction of the superintendent of outdoor work, who works directly under the board. He has charge of all departments except water works, parks and public buildings; in other words, he has direct supervision over the removal of refuse and garbage from residences and business blocks, the care and maintenance of streets, ways and bridges, which includes the building of sidewalks, repairing streets and bridges, and the sprinkling of streets.

The charge for the work is returned to this office on sheets similar to the one enclosed. The time for the men is returned on a time sheet, a copy of which is enclosed herewith. The job time sheets are numbered on the black line in the upper right-hand corner; the department is stamped on the line after the word "Department." The week ending is inserted on the proper line, and the blank lines after the word "work" are so that the timekeeper can properly designate what the work is. The day of the month is inserted in the proper column and the name of the foreman for whom the men work. On the job time sheets no names are inserted. The blackface figures are the rates per hour paid. For illustration, the column headed 25 is for men receiving 25 cents an hour or $2 per day. The 37½ cents column is used for skilled laborers, for masons' tenders, engineers of rollers and some other workmen. The column 26¾ represents the wage scale of $2.14 a day for eight hours, practically $15 per week. This rate of wages is paid to the drivers of teams owned by the city. The 50-cent column is now obsolete and should read 56¼, which I have inserted above this column, and is used for teams hired by the city. This represents a wage scale of $4.50 per day of eight hours. The 40-cent rate is obsolete and should read 40⅝, representing the rate paid some of the foremen. I have noted this above the figures on the sheet; this represents a wage scale of $.25 per day of eight hours. The 34⅜ represents a wage scale of $2.75 a day and is paid to carpenters. The 61¼ column represents the wages paid per hour to bricklayers and masons. The 28¼ column is $2.25 per day paid to some of the skilled and permanent men, men whom we keep at work the year around. These men being familiar with the various departments, are called upon in storms to care for certain sections of the city. The rate 18¾ represents $1.50 a day paid to women scrubbers or cleaners in our public buildings; also this rate is paid occasionally for single horses hired by the board without drivers. We have one or two men whom we pay 31¼ cents

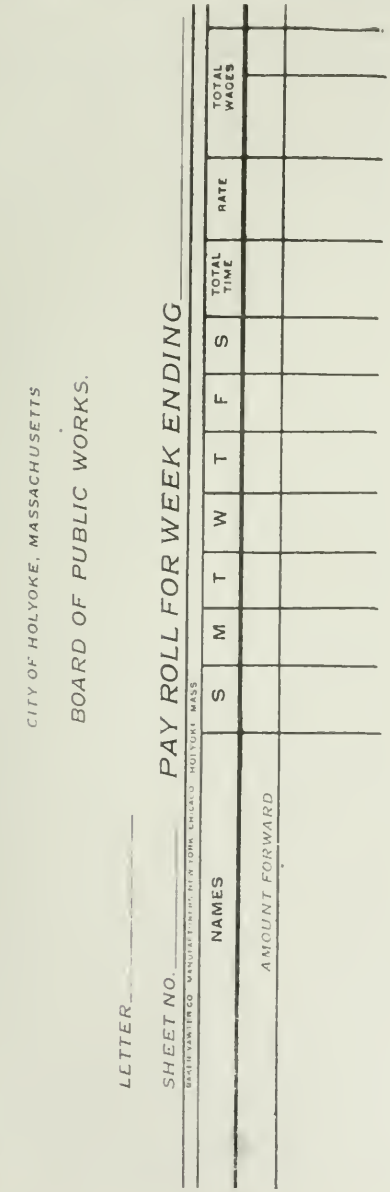


or $2.50 a day; these are practical, skilled workmen. The rate of wages in Holyoke, as paid by the city of Holyoke, is about the same as is paid by contractors or other large employers of labor.

The total number of hours which each foreman has on a particular job on any particular day is simply entered in the proper column, and the sheet may contain the returns on that job from several foremen, so that at the end of the week the total of the columns represents the total number of hours of labor that has been expended upon any job during that week by all of the workmen in our employ.

I should be very glad to answer more in detail any questions that you might like to ask, but this in brief covers the general outline of the way that our time is made out.

OSCAR C. FERRY.
Assistant Clerk Board of Public Works, Holyoke, Mass.



Concrete Boundary Monuments.

Concrete is now generally recognized as a cheap and eminently satisfactory substitute for granite for use as boundary monuments. The following details of construction and cost are therefore of interest. They are drawn from the report of Leonard Metcalf, civil engineer, Boston, to Kennebec Water District, Waterville, Me., and relate to an exceptionally fine piece of work done under Mr. Metcalf's direction in connection with the China Lake water supply.

These monuments were built upon the ground in post holes 5 feet or more in depth and in forms, either flush with the ground in meadows and pastures, or about 1 foot above the surface of the ground along fence and property lines. The monuments were of the following general form: Below the ground, 8 inches in diameter, 5 feet in depth, with the base flared out to from 4 to 6 inches greater diameter; above the surface of the ground or at the top of the post, 6 inches square for a length of 6 or 16 inches, according as the monuments were built flush with or above the surface. In the four corners of the square top and extending to the bottom of the post were bedded bars of ¼-inch steel, bent in U form across the top of the post. In the top of the post was bedded a small iron casting with expanded bottom bearing the letters K. W. D. and the number of the monument, as, for instance, K. W. D. 95.

The concrete of which these monuments were made was mixed on the ground in the proportion of one part of Portland cement to two parts of sand to four parts of gravel or broken stone of approximately ½-inch diameter.

The cost of these monuments was considerably less than it would have been for granite monuments, and it is believed that they will prove even more satisfactory, since it seems probable that there will be less danger of heaving by frost; time alone, however, can determine whether this is the fact. The total cost of the monuments in final position averaged about $4.30 each, including therein the cost of all maerials, supplies and forms, and all teaming, labor and supervision.

COST OF MONUMENTS.

	No. Built.	Cost per Month.	Average.
September ..	52	$211.85	$4.07
October	36	160.25	4.45
November ..	15	65.25	4.35
Total 103		$437.35	$4.25

This includes $1 per day for 48 days for district horse, but does not include cost of forms, which amounted to between $4 and $5, making the total average cost per monument (in place) $4.30.

MUNICIPAL MATTERS IN COURT

Higher Courts—Water Company Liable for Fire Loss—Foreign Drainage Outlet

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Recovery of Money Illegally Paid to Councilman—Suit by Taxpayer.—Where there is no statute providing for recovering back money illegally paid to councilmen as compensation, a suit in equity may be prosecuted for that purpose by any taxpayer on behalf of the municipality or on behalf of himself and other taxpayers, and in such suit all the councilmen so illegally receiving money may be joined in one action to prevent a multiplicity of suits.—Walker v. Village of Dillondale, 30 Ohio Cir. Ct. R. 623.

Municipal Bond Issue in Excess of Constitutional Limitation—Effect of Contrary Recital.—If municipal bonds disclose upon their face an issue in excess of the constitutional limitation, a purchaser cannot rely upon a recital to the contrary. * * * The purchaser of such municipal bonds is bound to ascertain at his peril from the public records the amount of such valuation.—St. Lawrence Tp. v. Furman (U. S. C. C. A., S. D.), 171 F. 400.

City Not Liable for Negligence of Independent Contractor.—A municipal corporation is not responsible for the negligence of an independent contractor, where it appears that the work about which said independent contractor was employed was not intrinsically dangerous, and where such work was not such as a municipal corporation was under a primary and inalienable duty to perform by itself.—Fields v. Johnson City, 143 Ill. App. 485; Mathis v. Same, Id.; Follis v. Same, Id.

Vessel Damaged by Swinging Bridge—Liability of City.—The city of Chicago is liable to the owner of a vessel for damages caused thereto by the negligent act of an employe of such city in control of a bridge in swinging such bridge against such vessel.—(1908) Lehigh Valley Trans. Co. v. City of Chicago, 141 Ill. App. 618; judgment affirmed (1909), 86 N. E. 1093.

Declaration by Ordinance That Building Is Nuisance Is Not Conducive.—The mere declaration of a town council by ordinance that a building is a nuisance will not make it so, unless it is such in fact.—Town of Lonoke v. Chicago, R. I. & P. R. Co. (Ark.), 123 S. W. 395.

Ordinances Against Acts Not Wrongful Per Se.—Municipalities cannot unduly interfere with the liberty of citizens by ordinances against acts not unlawful or wrongful per se.—City of Carthage v. Block (Mo. App.), 123 S. W. 483.

Tax Levy for Specific Purpose Does Not Exhaust City's Power in the Premises.—The levy and collection of taxes by the city of New Orleans to satisfy outstanding debt of metropolitan police board held not to exhaust the city's power in the premises.—State of Louisiana v. City of New Orleans, 30 Sup. Ct. R. 40.

Law Authorizing Proceedings in Circuit Court to Have Land Excluded from City Limit Held Constitutional.—The statutes of South Dakota (Pol. Code Sec. 1511) providing that on failure of a city council to exclude land from the city limits upon the owner's petition, such owners may file a petition in the circuit court, and section 1512, authorizing the court to order that the petition be granted, if upon hearing it appears it should be granted, are not unconstitutional as investing the circuit court with legislative powers.—Wickheur v. City of Alexandria (S. D.), 122 N. W. 597.

Damage to Building by Construction of Sewer in Adjoining Alley.—The damage to a four-story brick building and its contents by the laying by the city of St. Louis of a sewer in an adjoining alley below the plane of the foundation of the building, after the owner knew in time to protect the building that the sewer was to be laid and might cause his building to settle, whereby the lot was not caused to settle, but the building was cracked and its contents injured, is, according to the decisions of the Supreme Court of Missouri, damnum absque injuria (damage without injury), and the owner is not entitled to compensation under Const. Mo. art. 2, sec. 21 (Ann. St. 1906, p. 148), providing that private property shall not be taken or damaged for public use without just compensation.—Johnson v. City of St. Louis (U. S. C. C. A. Mo.), 172 F. 31.

Tax Levied upon Street Cars as License Fee.—The city of Pittsburg brought an action against the Pittsburg Railways Co. upon a claim of $94,200, which indebtedness arose by virtue of two city ordinances. The first ordinance operative from and after February 1, 1894, provided that "all street passenger railway compa-

nies shall pay into the city treasury $60 per annum for each and every car used on the streets of the city of Pittsburg whose lines are entirely within the city, and $30 for each and every car of those companies whose lines are not entirely within the city, the amount to be paid as a license fee. The second ordinance, operative from February 1, 1907, provided that all street railway companies operating in Pittsburg shall pay into the city treasury $100 per annum for each and every car used on the streets of the city. *Held*, That the city had no authority under the act of March 7, 1901, P. L. 20, to impose a license fee upon the street railway company as a revenue measure, nor would the ordinance be valid as imposing a fee for compensation to the city for police inspection and supervision. The court based its ruling upon the case of Pittsburg Railways Co. v. Pittsburg, 211 Pa. 479.—Pittsburg v. Pittsburg Ry. Co. (Pa. 1909).

Board Walk Patched with Two-Inch Planks Not Unsafe.—A municipal sidewalk is not as a matter of law unsafe so as to come within the meaning of a statute imposing a liability upon the municipality for injuries to pedestrians caused thereby, merely because in making repairs, a patch of two-inch planks was spiked on top of the former planking, so as to leave an abrupt inequality in height of two inches between the portions of the walk. —Kawiecka v. Superior (Wis.), 118 N. W. 192.

Mandamus to Compel Railroad Co. to Open Public Road.—A mandamus to compel railroad to reconstruct and open a public road closed by its tracks must be instituted by the attorney general or the district attorney, and not by the borough on the relation of the burgess.—Bellevue Borough v. Pa. R. R. Co., 18 Dist. Reports 945.

Acceptance of Franchise Granted by City.—In the absence of any statute requiring a different acceptance of a franchise or privilege granted by a cit, a written acceptance thereof subject to the conditions imposed is unnecessary, and the actual enjoyment of the privilege is a sufficient acceptance to create contractual obligations.—City of Superior v. Douglas County Telephone Co. (Ill.), 122 N. W. 1023.

City's Contract with Telephone Company to Maintain Telephones Without Cost in Public Offices.—A contract binding a telephone company operating in a city to maintain telephones in the public offices in the city building and in the public library building, without cost to the city, entered into at a time when there was no statute prohibiting the company from granting the city a different rate for service than general customers, is not invalid because creating an unjust discrimination. . . . Communication by telephone with the public offices of the city renders the service the company offers to its general customers more valuable, and the granting by the city of such a right to the telephone company operates to expedite public business, so that such a right is a legitimate basis for such a contract between the company and the city.—Idem.

Water Company's Contract with City to Furnish Free Water to Public Schools.—The requirement of a contract by a water company with a municipality that free water be furnished public schools, churches, town offices, market houses for city use, and all other town offices, can not as to the public schools be avoided, because such schools are controlled by a corporate body other than the municipality, and no charge upon water furnished can be made for children attending the schools who live outside the municipal limits. . . . Such requirement to furnish free water to public schools does not include water for sprinkling lawns, playgrounds or for bathrooms or bathing pools, but only for drinking purposes, for toilet and water closets.—Henderson Water Co. v. Trustees of Henderson Graded Schools (N. C.), 65 S. E. 927.

City Not Liable for Injury to Prisoner. —A city is not liable for injuries sustained by one while breaking rock on the municipal rock pile to pay a fine, in consequence of a splinter of the hammer, used by another engaged in a like occupation, flying off and striking him in the eye, though the accident was caused by the negligence of its officers.—Jackson v. City of Owingsville (Ky.), 121 S. W. 672.

Defective Construction of Culvert—City's Liability for Resulting Injuries.—The rule that no damage can be recovered from a municipality for injuries resulting from a failure of judgment on the part of the officers of the municipality in constructing a sewer to carry off surface water, does not apply to the construction of a culvert or drain to carry a highway over a natural stream of water.—Metzgar v. Lycoming Tp., 39 Pa. Super. Ct. 602.

Public Improvement in Excess of Estimated Cost—Expenditure Without Proper Notice—Assessment.—Laws of 1903 (p. 231, c. 124), declare that in proceedings for the enforcement of special assessments, where the work has been done which would be properly chargeable on the property assessed, a recovery shall be permitted to the extent of the proper proportion of the value thereof, chargeable on the land, notwithstanding any informalities in the proceedings. *Held*, that where the estimated cost of a public improvement was $6,000 and the city permitted an expenditure therefor of $14,-$12.50 without proper notice to the property owners, the property was still subject to assessment for its proper proportion of the original estimate.—Rehearing 102 P. 1027 denied.—City of Chehalis v. Cory (Wash.), 104 P. 768.

Bonds—When Included in Determining Indebtedness of a City.—Bonds of a city

to pay the cost of local improvements, which are the absolute and unqualified obligations of the city, and which are issued on its faith and credit alone, and which, when due, are payable directly by it, are debts of the city, within Const., art. 8, sec. 10, though the cost is assessed back more or less on the property benefitted, as the lien on the property can be regarded only as a general asset. . . . Bonds issued under Greater New York charter (Laws 1901, p. 72, c. 466), sec. 187, for purposes other than to meet expenditures under the appropriations for each current year, and made redeemable out of the tax levy for the year next succeeding the year of their issue, under an appropriation therefor by the board of aldermen and the board of estimate and apportionment in the budget for such years, when issued in one year to be redeemed in the following year, may not be included in computing the indebtedness of the city, within Const., art. 8, sec. 10. . . . City bonds held by the sinking funds thereof are not debts within Const., art. 8, sec. 10.—Certified Questions, Fleishmann Realty & Const. Co. v. McClellan, 116 N. Y. S. 1087, 132 App. Div. 913, answered.—Levy v. McClellan, 89 N. E. 569; Meyer v. Same, Id.; Fleishmann Realty & Const. Co. v. Same, Id.

Mode Prescribed in City Charter for Supply of Light Is Exclusive.—The supplying of light by a municipality is a "necessary expense" and is a power necessarily and reasonably implied in its general grant of powers, and can be exercised unless expressly forbidden, but the mode prescribed in the charter is exclusive.—Henderson Water Co. v. Trustees of Henderson Graded Schools (N. C.), 65 S. E. 927.

City's Contract with Individual to Operate Market House Does Not Create a Monopoly.—A contract between a city and individuals for the erection by the latter of a market house, which shall be under the control of the city, and which fixes the minimum rental for stalls therein, and which gives the city an option for the purchase of the property at stated periods, and binds the city to pay a rental equal to the city taxes on the property until the enterprise is on a paying basis, is not invalid as conferring a monopoly on the individuals within Const., art. 1, sec. 31, but is valid within the police power of the city to protect the health.—State v. Perry (N. C.), 65 S. E. 915.

Liability of Water Companies for Fire Loss Due to Inefficient Service.

In a recent paper on water works valuation, Leonard Metcalf, consulting engineer, Boston, points out that a consideration which heretofore probably has had little weight in water works valuation, but which may depreciate properties of this character permanently, is that of the financial liabilities of water companies for loss incurred by fire in which inadequate fire service can be proven. Court decisions have been numerous upon both sides of this question, but the weight of decisions has, before the Greensboro decision, been largely in favor of the water companies, upon the technical ground that, inasmuch as the water consumers were no parties to the contract of the water company to furnish water to the city for fire protection (or, to use a safer word, water for fire service), they could not sue the water company for breach of contract. Judge Brewer, of the Supreme Court, in the appealed Greensboro Water Company decision, however, has taken the view of water-company liability based upon the broad ground of negligence, a decision of far-reaching important to many water companies, suggesting the need of the greatest care in the preparation and wording of fire-service contracts.

Outlet for Drainage Can Be Constructed in Foreign Country.

The Supreme Court of North Dakota reversed the decision of Judge Templeton, January 21, in the injunction proceedings against the drainage commission of McHenry and Bottineau counties, restraining them from constructing a drainage canal which would extend fourteen miles into Canadian territory. Judge Templeton decided in favor of the plaintiff, holding that it was unlawful for the commission to spend money raised by taxation in a foreign country. The Supreme Court reversed this decision, holding that under certain conditions, which existed in the present, the contention of the lower court was not right.

Work on the canal will now be commenced in the spring, to reclaim 25,000 acres of meadow land, which, at the present time is entirely useless, and arrangements have been made with the Canadian government for a proper oulet for the waters.

The gist of the decision is as follows:

Improving a water course after it passes beyond the drainage district for twelve or fourteen miles into foreign territory, for the purpose of making an improvement of the water course in this state efficacious, is not an unreasonable exercise of the power of securing an outlet for drain purposes.

Florida Decision That Water Company Is Responsible for Fire Loss.

The case of Robert Mugge against the Tampa Water Works Company, Tampa, Florida, was tried in the Circuit Court in that city, and the jury returned a verdict of $11,500, with interest, making a total of $15,000 for the plaintiff. The case, which was on trial for eighteen days, created intense interest at Tampa and elsewhere, for, being the first of its kind ever tried in that state, on it depend a number of other suits involving a loss of $500,000 in property at the conflagration of

Ybor City, in March, 1907. In this fire more than thirty buildings were burned, through the failure of the water company, the plaintiffs allege, to supply adequate water protection.

In charging the jury, Judge Wall said:

If you find from evidence that the failure to extinguish the fire was the proximate result of any defect in the appliances or apparatus of the fire department, and not failure of the water works company to furnish the pressure on its mains as called for in its contract, you should find for the defendant. If you believe from the evidence, applying to it the law as given you in these instructions, that the defendant failed to furnish water as called for by its contract with the city, and that, had the defendant complied with its contract about furnishing the water, the fire would have been put out, and by reason of its fault plaintiff's property was destroyed, you should find for the plaintiff. If you find that the company did comply with its contract, or if you find that even if the water had been supplied the building would have been destroyed, you should find for the defendant.

MUNICIPAL PROBLEMS

Fort Worth Charter Service—Passaic Valley Sewerage—New York Water Power—Want New York City Water.

Fort Worth Charter Valid.

A firm of bond buyers of Boston, Mass., raised a question recently as to the validity of the city charter of Fort Worth, Texas, because of alleged irregularities in its passage through the legislature. An opinion filed by Attorney General Lightfoot, February 8, holds, however, that there is no cloud on said charter. The journals of the house show that it was read on three several days as required by the constitution. Mr. Lightfoot finds, furthermore, that when the constitution means a certain vote taken for any purpose shall show a certain fraction of the "members elect" participating therein the constitution specifically so states as in the case of the provision governing the vote to give the emergency clause immediate effect. With regard to suspending the rule requiring bills to be read on three several days, however, there is no reference to "members elect," which leads to the conclusion that four-fifths of a quorum is all that is needed for that purpose.

Other Municipalities Want Some of New York's Water at Cost.

The towns of Westchester county, New York, are moving to secure an amendment to the Catskill water supply law reducing the charge to municipalities along the aqueduct which may take advantage of the privilege to draw from that main. The rate, according to the law, shall be the same as that paid by New York city consumers and thirteen cents a thousand gallons is now being paid. The down-river towns say this "includes all cost due to fixed charges sinking fund maintenance and operation of the distributing system within New York city, as well as the losses due to leakage in said distributing system, in the use of which the municipalities in Westchester could not join."

These towns declare that thirteen cents is an excessive rate ,and the fact is pointed out that the metropolis will profit by the sales of water to the municipalities, as the increased consumption will not be attended with any additional cost to the city. The amendment of the law so that municipalities will pay for water taken from the aqueduct at the same rate the water costs the city of New York down to the point of connection is urged.

The request for a lower rate is generally regarded as reasonable and just.

Passaic Valley Sewerage Commission Decision.

The Passaic Valley Sewerage Commission has begun advertising its intention of introducing in the legislature of New Jersey a bill specifically authorizing the commissioners to sign the agreement reached between them and the government. This would put an end to the long-pending litigation over the postponed sewer, so far as the government is concerned. The notice of intention was to be advertised for one week and the proposed act then presented to the legislature.

State Water Power Development Recommended by New York Commission.

The Water Supply Commission of New York has recommended to the legislature an amendment to the constitution permitting an issue of $20,000,000 state bonds for building storage reservoirs with a view to generating electric power and controlling the water flow of the streams of the state. After thoroughly investigating the question, the commission estimates that 1,500,000 horsepower of water energy is running to waste in the state annually, and that it would have a yearly rental value of $15,000,000 if properly controlled.

The interest charge on the cost of de-

veloping this water power is placed at $3,000,000 a year, leaving an annual revenue to the state of $12,000,000. The commission states that the time has arrived for the state to adopt a plan of water power conservation not only for the purpose of generating electric power but with a view of regulating the flow of our rivers and to make possible the control of floods.

MUNICIPAL AND TECHNICAL LITERATURE

Savannah Street Paving—Knoxville Water Works—Detroit Asphalt Plant—Washington Municipal Accounting—Boston Refuse Disposal—New Publications.

Street Paving in Savannah.

In his annual report J. W. Howard, city engineer of Savannah, Ga., states that 44.9 miles of streets have been paved during the year. The city's paving now aggregates the following:

	SQ. YDS.	COST.
Asphalt	140,814	$362,172.87
Vitrified brick	352,414	539,704.48
Asphalt block	174,285	380,434.03
Chert	14,912	
Cobblestone	123,070	
Granite block	88,568	
Shell	45,505	
Gravel	58,176	
		—493,378.32
Total	996,744	$1,775,689.70

The city has set aside $55,000 for paving new streets and $6,000 for re-surfacing with gravel and shell this year.

Knoxville City Water Works Report.

The sixth annual report of the water commission submitted to the city council of Knoxville, Tenn., recently, was the first report on the operation of that city's municipal venture from September 18, 1909, to December 31, 1909. The report shows at great length and in much detail the number of mains in use, when they were laid, their dimensions, the length of the pipes, and their location. The number of extensions made by the commission from the time of acquiring the plant, is also shown in detail. The summary shows that on December 31 the total mileage of mains was 581,385.3 feet, or 110.11 miles. The total number of hydrants is 385 and of valves 1,195.

Detroit's Municipal Asphalt Plant Report.

During the last year the municipal asphalt plant of Detroit, Mich., has saved that city $53,782.13. This is the best showing made, as yet, because during the last year the work done was fully half as great as the total of the work accomplished during the preceding five years. The plant and the gangs produced and laid during this year 198,559 yards of re-surfacing; 20,309 yards of repaving; 35,916 yards of patching. The cost of labor, etc., was lower than the average of the last five years. This year the re-surfacing cost 85 cents a yard, the former average being 88 cents; repaving, 80 cents against a former average of 83 cents; patching 93 cents against 94 cents. The cost of the work to the city was $257,152.76. It is estimated that under contract the cost would have been $310,934.94. The gross saving to the city during the last six years has been $146,698.59.

In addition to this 20 cents a yard for maintenance and 10 per cent for depreciation of the plant is reckoned. According to this reckoning, which is made by expert Clarence A. Proctor, the plant, which is worth $46,000, is six-tenths paid for by the work of the department itself.

Improved Municipal Accounting for Washington.

The Commissioners of the District of Columbia presented, in the report recently submitted, the urgency for the adoption of a well-organized and centralized system of accounting control of the finances of the District, together with a thorough analytical system of bookkeeping, in order that the business of the government could be transacted without financial loss and that the results of its business could be expressed accurately and intelligently. In urging a revision along these lines the commissioners have not contemplated the establishment of an intricate and voluminous system of bookkeeping with endless extensions and ramifications. What is desired is in line with that which has already been partially accomplished, namely, revision along practical business lines, the accomplishment of practical results; that there may be centralization instead of decentralization in financial control; that all receipts and disbursements of the District may be handled through the proper officers of the District; and that all ac-

counts relating to the District may be kept in the District auditor's office, so that annually the Commissioners, with full knowledge of all the facts relating to all of the business of the District, may submit to Congress an accurate and comprehensive statement of the business transactions of the District of Columbia.

Boston Report on Collection and Disposal of Refuse.

The second special commission on the collection and disposal of refuse in Boston submitted its report January 31. The document goes into detail regarding the present methods and those which it thinks are better. Some extracts from the report will appear later. The final conclusions, aside from some of strictly local application, are as follows:

The commission recommends the disposal of the city's entire waste by burning in modern incinerators of the so-called English "Destructor" type, operated by forced draft and at a temperature of not less than 1,500 degrees F. Such destructors should be introduced gradually, beginning with the district in which the need is most urgent and extending to other districts of the city as required.

The commission recommends the immediate construction in the Roxbury district of a destructor capable of burning 300 tons of mixed refuse per twenty-four hours. This and all other destructors should be so designed as to be capable of enlargement, with a minimum of interference and expense, as necessity may arise.

The commission further recommends that the contract with the City Refuse Utilization Company, now on a thirty-days' footing, be terminated, with a view to securing more advantageous terms for the city, not necessarily by continuing operations at the present location on Hecht's Wharf.

The plan of combining disposal by incineration, in destructor plants of the type recommended above, with a garbage reduction plant so designed as to prevent the escape of foul odors, might enable the city to dispose of its waste effectually and satisfactorily by contract, at less cost than by the burning of mixed waste in its own destructor plants. The contract plan tentatively outlined to the commission involved both the collection and disposal of all wastes at a cost much less than would be required if the work were done by the city. It has already been pointed out that this plan admits of separating the collection of waste from its disposal, and the commission recommends that if the plan be again presented, either in its original form or as thus modified, the desirability of its adoption be given careful consideration.

In view of the importance of utilizing the surplus power developed by the destructors, it is essential that immediate consideration be given to the question of the most favorable locations for prospective destructor plants, with due regard both to the convenience and general suitability of such locations and to the disposal of power.

The majority of the members of the commission are of the opinion that it would be to the advantage of the city in either case to do the work by contract and, if a suitable contractor can be found, that it would be better to let the entire work of collection and disposal for the whole city to one contractor.

New Publications.

Curves for Calculating Beams, Channels and Reactions. A manual for engineers, architects, designers, draughtsmen, builders and contractors. By Sidney Diamant, E. E., structural engineer. Cloth, 13 pp., 25 plates. $2 net. McGraw Publishing Co., New York City.

The sets of diagrams given are intended to reduce the labor of computing beams for structural designs. The formulae and assumptions are explained, and the methods of computing readily the effects of changes from the assumptions used. The first set of thirteen diagrams enables one who knows or assumes any two of the three quantities, length of span, width of supported area and size and weight of I- or channel-beam, to determine the third. Each diagram has a different loading per square foot of the supported area, ranging from 80 pounds in the first plate to 500 pounds in the thirteenth. Tables of properties of standard channels and I-beams make selections of beams easy. The last twelve plates enable one knowing the half span and the width of supported area to find directly the beam reactions. The diagrams are simple and clear and should be easily used. Interpolations can be made easily, and at the same time the diagrams are not so close as to be difficult to read or hard on the eyes. Good judgment has been used in this respect.

Sewer Construction. By Prof. Henry N. Ogden, C. E. Cloth, 347 pp., $3. John Wiley & Sons, New York.

Designed as a text-book for his classes in the College of Civil Engineering at Cornell University, the author has, on account of his experience in construction, been able to make as well a very practical book, of value to the young engineer in the field or the engineer attacking his first problem in sewer construction. His earlier book on "Sewer Design" ($2) gives that part of the subject, so that this book can be devoted wholly to the construction end. Special acknowledgment is made of material concerning examples of construction taken from several publications, including MUNICIPAL ENGINEERING, but in the foot-note acknowledgments the credit is given under the title *Paving*, which was dropped from the title of this magazine with the tenth volume, in 1896.

The subjects of the chapters are terra cotta pipe, brick, concrete, concrete and

brick, and reinforced concrete sewers, manholes, catchbasins, siphons, screens, storm water overflows and regulators, bell mouths, foundations, outfall sewers, house connections, surveying, trenching, estimates and costs, specifications and contracts. It will be seen that practically all the subjects are covered. It is not difficult to determine from the methods of treatment of the various chapters which are the result of his own experience, but he has nowhere departed from safe practice and is usually clear in his explanations. Not all engineers will agree with the detail of some of his methods of work, but they will secure good work at reasonable prices.

The last chapter gives a set of specifications which has passed the test of use under severe conditions, but the author shows some really serious faults in some of the clauses. He does not give sufficient warning that the form of the specifications and contract will not suit all conditions, possibly because all his work has been done in one state or in states following the same general methods. Very material modifications will be necessary to fit them for use in some of the states of the Union, not as regards the engineering features, but mainly in the general clauses and those affecting the relations of contractor, employer and engineer.

Staley and Pierson and Folwell are the standard authors on sewer construction, and Ogden may now be added to the list, because, while he does not cover some points quite as satisfactorily, he covers the ground more completely and brings the art of sewer construction down to date.

Report of the Municipal Art Commission for the city of Los Angeles, Cal., to the mayor, city council and board of public works. Charles Mulford Robinson, Rochester, N. Y., and others.

The major part of this well-printed and illustrated report is taken by the well-considered and detailed recommendations of Mr. Robinson. He covers the lighting of the business streets, beautifying of residential streets and river, and proposed union railway station and approaches, administrative center, parks, boulevards and parkways, with illustrations of what has already been done in the city, the natural backgrounds, which add so much to the beauty of whatever may be done, and the successful efforts of other cities.

F. W. Blanchard discusses the suburban roads briefly, City Engineer Homer Hamlin shows what the city is doing and proposes to do with its bridges, and City Clerk Harry J. Lelande describes the Owens river aqueduct now under construction.

ORGANIZATIONS AND INDIVIDUALS

Chicago Cement Show—National Association of Cement Users—Northwestern Cement Products Association—Cement Tile Makers

The Chicago Cement Show.

The great Chicago Cement Show, held February 18 to 26 in the Coliseum, Chicago, was the Mecca of conventions this year. Reports of parts of several accompany this article, others were held after this number was on the press and will be reported later.

The exhibit was larger than ever, spreading over all the available space in the Coliseum and annex. A late count shows about 225 exhibitors, and not all those who doubled up with others are included.

There were 12 cement companies, notable among which were the Alpha, Atlas, Chicago, German-American, Lehigh, Marquette, Sandusky, Universal and Wolverine.

All conceivable materials and machinery and tools for using cement were on exhibit, and it is impossible to name them all. A few of the more notable are all that can be crowded into this brief mention.

Among the exhibitors of concrete mixers the Ashland Steel Range and Manufacturing Co. is deserving of special notice. Waterproofings of various sorts were shown by the American Asphaltum and Rubber Co., Chicago, the Barrett Manufacturing Co., Chicago, the Girvan-Nachod Co., Philadelphia, with aquabar, Standard Asphalt and Rubber Co., Chicago.

The Fisher Hydraulic Stone and Machinery Co., Baltimore, Md., as usual, had one of the most notable exhibits of machinery for making concrete blocks. Robert W. Hunt & Co., Chicago., had a model cement testing laboratory in active opera-

tion. The Marblehead Lime Co. showed the many uses of hydrated lime. Meacham & Wright had their usual popular headquarters for receiving the many friends they have among the users of Utica natural hydraulic cement and Lehigh Portland cement. The Troy Wagon Works Co., Troy, O., showed their bottom dump boxes and wagons, a teaming gear and a reversible road-building wagon. The Universal Brick Co., Utica, Ill., made a good showing of the very excellent pressed cement brick which they manufacture. The Waterloo Cement Machinery Corporation, Waterloo, Iowa, showed the full line of "Polygon cement machinery," mixers, engines, block, brick and tile machines, etc.

The decorations remaining from the automobile show were made use of and added to largely. The prize monument at the center of the show was an attraction for all. Electricity was the motive power for most of the exhibits, some of which showed sectional working models. All these things and the conventions, perhaps, joined to make this the greatest show with the largest attendance that has yet been brought together.

National Association of Cement Users.

The sixth convention of the National Association of Cement Users was held at the Auditorium Hotel, Chicago, February 21-25.

The afternoon of the first day was devoted to the meetings of the section committees of the society and the section on Roadways, Sidewalks and Floors. The usual addresses of welcome opened the evening session. Tuesday evening's session was largely a Washington's birthday celebration, and the rest of the convention was all hard work three sessions a day, without any reference to the Cement Show.

Among the more important papers on the program were the following: "Concrete Blocks in Road Construction," by Geo. C. Wright, C. E., Rochester, N. Y.; "Concrete Road Construction," by Fred R. Charles, City Engineer, Richmond, Ind.; "Laying Concrete Under Water," by Olaf Hoff, C. E., New York; "Groined Arch in Large Reservoirs," by T. H. Wiggins, C. E., New York; "Waterproofing of Concrete," by C. M. Chapman, New York; "The Preparation of Concrete," by Harry F. Porter, C. E., Bridgeport, Conn.; papers on reinforcement of concrete compression members by R. A. Cummings, C. E., Pittsburg, Pa., L. S. Moisseiff, C. E., New York, N. Y., Prof. Peter Gillespie, Toronto, Ont., Sanford E. Thompson, C. E., Newton Highlands, Mass.; "Strength of Flat Reinforced Concrete Plates," by A. B. MacMillan, C. E., Boston, Mass.; "Long Span Light Floor Reinforced Concrete Construction," by E. G. Perrot, Arch., Philadelphia; "Concrete Drain Tile," by J. H. Libberton, Chicago, Ill.; "Hollow Concrete Block Construction," by E. B. McCready, Allentown, Pa.; "Floor Construction Cost with Separately Molded Concrete Members," by C. D. Watson, Syracuse, N. Y., and Mason D. Pratt, city engineer, Harrisburg, Pa.; concrete for houses and farm buildings, by S. Cunningham, Jr., New York, C. R. Knapp, Philadelphia, and M. D. Morrill, Arch., Washington, D. C., concrete in sea water, by C. M. Chapman, New York, C. C. Horton, San Francisco, and Ralph Barker, San Francisco.

There were also some excellent committee reports, particularly the standard specifications proposed for adoption for street pavements, curb and gutter, sidewalks, architectural concrete blocks, drain tile, and the proposed standard building regulations for reinforced concrete.

The election of officers was held too late to be reported here.

Northwestern Cement Products Association.

The Northwestern Cement Products Association held its convention in a parlor at the Great Northern Hotel, Chicago, Friday afternoon, Saturday morning and Monday, February 18, 19 and 21.

The addresses were by E. M. Hagar, president of the Cement Products Exhibition Co., O. U. Miracle, of the Miracle Pressed Stone Co., Minneapolis, Minn., on "Cement Sewer Pipe," A. W. Menk of the Consolidated Elevator Co., on "Concrete Country Grain Elevators," and J. V. Godfrey, of Moorhead, Minn., on "A Concrete Cattle Barn." The convention was not large, and with the regular president ill and secretary resigned it was somewhat at a loss. The Universal Portland Cement Co. filled in Saturday afternoon with a trip to its Chicago plant. The election of officers took place too late to be included in this report.

Standardizing Paving Specifications.

The first convention of city officials and engineers for the purpose of standardizing paving specifications is in session as this number of MUNICIPAL ENGINEERING goes to press. It was called by the Board of Local Improvements of Chicago under the temporary chairmanship of Frank T. Fowler. Two days, Monday and Tuesday, were provided for organization, and the discussion of brick, wood block and asphalt specifications were each assigned a day.

The American Society of Municipal Improvements at its last convention appointed a committee on standard specifications which is represented at the convention, the need for standards, particularly in paving matters having been felt in that organization for some time. It is hardly probable that the convention can take final action on all the specifications under consideration at this first meeting, but the discussion at a meeting called expressly for the one purpose should cause a long step in advance.

The officers of the permanent organization are Frank T. Fowler, superintendent of streets, Chicago, president; Geo. W. Tillson, chief engineer of highways, New York City, vice-president; W. J. Hardee, city engineer, New Orleans, vice-president; L. W. Rundlett, city engineer, St. Paul, Minn., vice-president; Geo. W. Craig, chief engineer, Omaha, Neb., vice-president; John B. Hittell, street engineer, Chicago, secretary and treasurer.

Cement Tile Manufacturers.

The Interstate Cement Tile Manufacturers' Association held its convention at the Lexington Hotel, Chicago, February 22 and 23. L. L. Bingham, of Estherville, Iowa, president, was responsible for the program, which included the following papers: "The Steam Curing of Cement Tile," by A. B. Elliott, Turin, Ia.; "The Cement Tile Industry, Past and Future," by C. W. Boynton, Universal Portland Cement Co., Chicago; "The Sale of Cement Tile," by E. M. Middleton, Estherville, Ia.; "The Use of Cement in Winter and Notes on Steam Curing," by George Dieckmann, chief chemist Northwestern States Portland Cement Co.; "Should Cement Tile Be Dense or Porous?" by C. F. Hunt, Lafayette, Ind.; "Data on the Rack System," by George F. Sokal, Sibley, Ia.; "Marketing Our Product," by R. L. De Nice, Sac City, Iowa.

Charles E. Sims, Worthington, Minn., is secretary of the association.

Ohio Engineering Society.

The annual meeting of the Ohio Engineering Society was held at Columbus, O., Feb. 8, 9 and 10. Among the papers submitted were the following: "Some Principles Governing the Design of Small Sewage Purification Plants," by Paul Hansen, Assoc. Mem. Am. Soc. C. E., acting chief engineer Ohio State Board of Health. George P. Shute, of Bradbury & Shute, civil and sanitary engineers, of Columbus, contributed a description of a small water works system installed under his supervision at Medina, O. Col. J. M. Harper, of the committee on highways, reported on the "Road Preservatives and Dust Suppression Materials in Hamilton County, Ohio." He said: "Tarvia has been used on 13½ miles of macadam roadway and asphalt oil as a dust eliminator on 45½ miles. The use of these materials is reported to be satisfactory. The specifications provide for the application of from 2 to 2½ gallons of tarvia per square yard, which was paid for at a uniform price of 25 cents per square yard, including application. Roads treated 18 months ago, subjected to heavy traffic, are reported to be in good condition. The application of oil cost on an average of 2.9 cents per square yard, according to Col. Harper.

Clinton Cowen, county surveyor, read a paper on road construction in Hamilton county, Ohio, and Frank R. Lander, of Cleveland, county surveyor of Cuyahoga county, described the extensive road improvements of that county. D. W. Leitz, assistant state highway commissioner, described the experimental road recently constructed by the state highway department near Columbus. A paper descriptive of a flat slab reinforced concrete construction for road crossings over small waterways was read by Frank H. Kennedy, of Washington C. H. A. M. Felgate gave a detailed description of the Rocky river bridge at Cleveland.

Officers for the ensuing year were elected as follows. E. G. Bradbury, Columbus, Ohio, president; John Laylin, Newark, Ohio, vice-president; C. J. Knisely, New Philadelphia, Ohio, secretary-treasurer; J. M. Harper, Cincinnati, Ohio, F. J. Cellarius, Dayton, Ohio, A. F. Cole, Marietta, Ohio, and B. E. Trask, Granville, Ohio, trustees.

Technical Meetings.

The annual convention of the American Water Works Association will be held at New Orleans, La., April 26, 27, 28, 29 and 30. J. M. Diven, secy., 14 George st., Charleston, S. C.

The annual meeting of the Illinois Water Supply Association will be held at Champaign, Ill., March 8 and 9. Among the papers to be presented are the following: "Experience With Deep Well Pumps," F. C. Ainsbury, Champaign, Ill.; "Relation Between Typhoid Death Rate and Water Supplies of Illinois,"; Edward Bartow, Urbana, Ill.; "Water Supplies From Lake Michigan," W. C. Bouton, M. D., Waukegan, Ill.; "The Operation of Mechanical Filters," J. H. Brewster, Indianapolis, Ind.; "The Possibility of Pollution of Shallow Wells," C. B. Burdick, Chicago, Ill.; "Quality of the Waters of the Mississippi System," R. B. Dole, Washington, D. C.; "Legislation in Relation to Stream Pollution," H. M. Ely, Danville, Ill.; "A State Bureau of Municipal Information," J. W. Garner, Urbana, Ill.; "Use of Ozone in Treatment of Western Waters," W. F. Monfort, St. Louis, Mo.; "Action of Mississippi River Water on Metals," W. F. Monfort, St. Louis, Mo.; "Filtration of Water Supplies," J. L. Pearse, Chicago, Ill.; "Water Works Franchises," M. H. Robinson, Urbana, Ill.; "A City Water Supply from Shallow Wells," O. T. Smith, Freeport, Ill.; "Rate of Flow of Water Into Wells," A. N. Talbot, Urbana, Ill.; "Comparison of Hydrated Lime with Ordinary Lime in Water Treatment," C. E. Thomas, Chicago, Ill.; "Should Water Companies Furnish Private Services Free to Patrons to and Including the Meters?" E. P. Wheeler, Lake Forest, Ill.; "Significance of the Term Alkalinity in Water Analysis and the Determination of Alkalinity by Means of Indicators," E. W. Washburn, Urbana, Ill.; "Disinfection of Water," C. E. A. Winslow, Boston, Mass.; President's Address, Dabney H. Maury, Peoria, Ill.

The twenty-sixth annual meeting of the Connecticut Society of Civil Engineers was held at New Haven, Conn., February 8 and 9. Among the lectures was one on "The Water Resources of the Navajo Reservation, Arizona," by H. E. Gregory, professor of geology, Yale University, who was commissioned by the Government to investigate the whole of this arid reservation with a view of determining the amount of the water resources and the extent to which they may be utilized for the development of the region. Frederick L. Ford, city engineer of Hartford, Conn., also gave an illustrated lecture on "Eight Weeks Civic Study Abroad." Charles E. Chandler submitted a paper on "Dams Approved by Henry F. Potter," and Benjamin L. Hinckley, engineer of tests, N. Y., N. H. & H. R. R. Co., read one on "Problems Handled by the Test Department of a Large Corporation." Officers were elected as follows: President, Shepard B. Palmer; vice-presidents, Charles A. Kerry and A. W. Sperry; secretary and treasurer, J. F. Jackson.

The Civic League of St. Louis has now a long list of civic improvements to its credit from an ordinance providing for a city forester to the appropriation of nearly $2,000,000 by the city for parks and boulevards. Its latest publications are a map showing the location of the proposed improvements in this line, an illustrated report on bill-board advertising in St. Louis, showing its monstrosities and the contrast with the form this advertising takes in large foreign cities, and a defense of the provisions for a merit system which are included in the proposed city charter revision.

The proceedings of the tenth annual meeting of the National Civic Federation have been issued. The office of the association is at 1 Madison ave., New York.

The proceedings of the Merchants' Association of New York will hereafter be published in monthly numbers.

The report of the nineteenth annual meeting of the Massachusetts State Board of Trade has been issued. One most interesting section is the address of Charles W. Eliot on "The Complete Revolution in Business."

The Michigan Engineer is the annual volume of the Michigan Engineering Society. That for 1909, issued by A. L. Holmes, secretary, Grand Rapids, is unusually well put together. Three of the papers have been published in MUNICIPAL ENGINEERING, and there are several others which are equally valuable.

The Indiana Sanitary and Water Supply Association gives its whole program of fifteen papers, president's address, reports of officers, luncheon and banquet in one day, Friday, February 25. MUNICIPAL ENGINEERING goes to press too early to be able to report the success of the venture. Certainly the list of speakers is unusual, including Edward Bartow, C. Arthur Brown and J. W. Alvord of Illinois, Geo. A. Johnson of New York and Leonard Metcalf of Boston, as well as a number of sanitary experts and practical designers and operators of water plants in the state.

The second International Road Congress will be held in Brussels, July 31 to August 7, 1910, in connection with the International Exhibition. M. Mahieu, 244 boulevard Saint Germain, Paris, France, is the general secretary. He will furnish information and accept memberships. E. L. Powers, secretary of the American Road Makers' Association, 150 Broadway, New York, is his representative in America.

At the meeting of the Municipal Engineers of the City of New York, held February 23, William H. Burr presented a paper on "The Henry Hudson Memorial Bridge."

The Societa Mostra Politecnica, Milan, Italy, has an international permanent exhibition of reviews, technical journals and publications in connection with its permanent exhibition of machinery, building materials and technical articles.

At the February meeting of the New England Water Works Association papers were read by L. G. Powers of Washington on "Depreciation" with special reference to water works accounts, and by A. O. Doano of Boston on "The Purchase of Coal on Efficiency Basis."

The proceedings of the Cincinnati meeting of the National Municipal League have been issued in a handsome volume which can be procured for $4 from Secretary Clinton Rogers Woodruff, North American Building, Philadelphia, Pa.

The monthly report of the Merchants' Association Bureau of Inspection of San Francisco, Cal., shows much work done by the bureau since full details of the work done during the month in amount and quality are given. The number of defects discovered by the association's inspectors, which have been corrected on their complaints, is evidence of the necessity and the value of the work.

At the annual meeting of the Engineers' Society of Western Pennsylvania, officers were elected as follows: E. K. Morse, president; J. O. Handy, vice-president; A. E. Frost, treasurer; A. R. Raymer and Willis Whited, directors. The annual banquet was held January 29.

At the meeting of the Brooklyn Engineers' Club, February 10, Percy C. Barney presented a paper on "The Catskill Water System of the City of New York." At the informal Thursday night talk of March 3 Thomas B. Hamilton will give an illustrated paper on "The Making of a Marble Quarry."

The American Society of Engineering Contractors is holding its special Chicago convention as this number of MUNICIPAL ENGINEERING is on the press. It gives every indication of being a live organization which will fill a place heretofore va-

cant. Report of the convention will be given next month.

The Iowa Association of Cement Users holds its convention at Cedar Rapids, March 9, 10 and 11. Ira A. Williams, secretary, Ames, Iowa.

The Iowa Engineering Society held a convention at Cedar Rapids, Iowa, February 16 and 17. About 30 members were in attendance. The program, which brought about much antimated discussion, included the following papers: "Concrete Construction in Cold Weather," J. H. Chubb; "Rates for Electric Service," A. H. Ford; "The Direct Method of Illuminating Engineering," L. B. Spinney. Reports of committees were submitted as follows: Surveying and drainage, Seth Dean; sanitary engineering, A. Marston; roads and pavements, T. H. McDonald; railroad engineering, W. G. Raymond.

The Technical Schools.

The January bulletin of Purdue University contains the annual reports of the president and other officers.

The students of the Armour Institute of Technology, Chicago, issue *The Armour Engineer*, semi-annually. The first number of the second year contains a dozen excellent practical articles, from alumni and faculty of the institution and others.

Bulletin No. 34 of the University of Illinois, Urbana, Ill., contains a report of tests of two types of tile-roof furnaces under a water-tube boiler by J. M. Snodgrass.

Bulletin No. 33 of the University of Illinois contains a report of tests of tungsten lamps by T. H. Amrine and A. Guell, which is of great interest, as it adds much to the available information on the new electric light.

Collier's Weekly has made the amende honorable for a reflection cast on the integrity of the International Correspondence Schools of Scranton, Pa., by making a thorough investigation of the methods and results of the instruction given and publishing a report which is an excellent endorsement of the institution.

Bulletin No. 337 of the University of Wisconsin contains Daniel W. Mead's paper on "The Relations of Experimental Results to the Theory of the Tangential Water Wheel," based on tests made in the hydraulic laboratory of the University of Wisconsin, which is in charge of Professor Mead.

The new engineering buildings of the University of Kansas were dedicated February 25 with addresses by Dean Frank O. Marvin, President Richard C, Maclaurin, of the Massachusetts Institute of Technology, and President Ernest R. Buckley, of the American Mining Congress.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations as follows:

March 29, 30, 31: For senior mechanical and optical draftsman at the Frankford Arsenal, Philadelphia, Pa., at $1,600 a year.

Personal Notes.

George T. Bolton has been appointed city engineer at Cohoes, N. Y.

R. L. Gardner has been reappointed city engineer at North Adams, Mass.

Bion Arnold has been appointed subway engineer for the city of Chicago.

W. F. Gollaher has been appointed superintendent of water works at Mesa, Ariz.

Frank Weaver has been appointed city engineer to succeed L. A. Dillon at Hamilton O.

H. M. Talbott has been appointed city engineer to succeed E. B. Shipley at Owensboro, Ky.

W. E. Roche has been appointed assistant engineer in the city engineer's office at Ogden, Utah.

J. E. Thompson has been elected city engineer, succeeding S. D. Newton, at Knoxville, Tenn.

A. F. Harley has established an office for practice as a consulting engineer at Jacksonville, Fla.

Christopher Harrison has been appointed city engineer, his twelfth consecutive term, at Everett, Mass.

F. B. Mayer has been elected mayor and A. F. Helingren and G. R. Adams city commissioners at Alice, Texas.

Fayette Brown, president of the Brown Hoisting Machinery Co., Cleveland, O., died January 20, in his 87th year.

C. R. Eager, president of the California Construction Co., of San Francisco, Cal., died in that city recently, aged 63 years.

Mr. Alexander Potter has been elected an honorary member of the Association of Managers of Sewage Disposal Works of Great Britain.

W. J. Frederick has been elected mayor, and W. T. Keer, F. W. Baebel, J. W. Hill, B. F. Davis and W. B. Johnson, aldermen, at San Felix, Tex.

Cuno H. Rudolph, Gen. John A. Johnston and Major W. V. Judson compose the reorganized board of district commissioners of the District of Columbia.

Hon. John F. Fitzgerald, first mayor of Boston under the new city charter, which provides for a term of four years, was inducted into office February 7.

J. Q. Worley, of Kansas City, has been retained by the city of Wichita, Kan., to advise as to the value of the water plant which the city contemplates purchasing.

P. H. Norcross, Assoc. M. Am. Soc. C. E., of the Solomon-Norcross Co., Atlanta, Ga., has been appointed consulting engineer for the Georgia State Board of Health.

Nicholas S. Hill, Jr., consulting engineer, New York city, has established a laboratory for making tests and investigations in connection with water works and sewerage problems.

Henry B. F. Macfarland, for some years commissioner of the District of Columbia, is a member of the new law firm of Tucker, Kenyon & Macfarland, with offices at 1420 New York ave., Washington, D. C.

P. B. Beery, for fourteen years assistant manager of the Sandusky Portland Cement Co., Sandusky, O., has resigned to accept the position of secretary and treasurer of the Allentown Portland Cement Co., which will begin cement shipments in April with a daily output of 3,000 barrels. He will be in charge of the sales department. Charles A. Matcham, formerly general manager of the Lehigh Portland Cement Co., is president and general manager of the new plant, which

is a modern model designed so as to be readily doubled in capacity.

Charles A. Brown, who has been connected with the city engineer's office at Indianapolis, Ind., for fifteen years, has resigned and will engage in consulting practice ,with offices in the Indiana Trust Building.

Sam R. Murray, superintendent of the municipal asphalt repair plant at Indianapolis, Ind., from June, 1908, to January 1, 1910, has taken charge of the asphalt department of the bureau of highways at Denver, Colo.

Lewis C. Ashbaugh, M. Am. Soc. C. E., has been appointed assistant chief engineer of the county highway project at Los Angeles, Cal. Mr. Ashbaugh was formerly office engineer of the Central Colorado Power Co., at Denver.

Leonard C. Smith, who has been chief engineer of the department of water supply, gas and electricity, borough of Queens, New York, has been appointed engineer in charge, under the reorganization plan, reporting to the chief engineer, I. M. deVarona.

F. A. Hall, long with the Yale & Towne Mfg. Co., Stamford, Conn., as manager of the chain block and hoist department, has resigned to become vice-president and treasurer of the Cameron Engineering Co., Brooklyn, N. Y. R. T. Hodgkins, long his chief assistant, has been promoted to fill the vacancy.

MACHINERY AND TRADE

The Cummer Portable Asphalt Paving Plant.

Nine of the Cummer one-car portable paving plants for building sheet asphalt, tar and asphalt macadam pavements were built in 1909. The plant consists of a sand drum with a capacity of 20 tons an hour; a steam-jacketed Iroquois mixer of 9 cubic feet capacity with steam cylinder for opening gate; a 5-ton capacity steel sand bin with rotary screen; 3 open kettles, with hinged covers, each 280 cubic feet capacity with a small steam-jacketed pressure tank to discharge melted asphalt to mixer platform; an oil pump and measuring tank; two dryer elevators for sand or rock, and one steel-encased hot-sand elevator, a sand box on scales with two beams and tare beam; an asphalt crane with hoisting engine and drum; 4-inch asphalt piping with 5-inch steam jacket; 80-h. p. engine; 9½-inch air pump, 60-h. p. vertical boiler, etc. A mechanically agitated closed kettle can be substituted for one of the open kettles. The large capacity of the plant is attributed to the large capacity of the sand dryer, which supplies all the sand the plant can possibly use.

Full information about the plant will be given by F. D. Cummer & Son Co., Cleveland, O.

Cement Brick.

The Universal Brick Co., Utica, Ill., have issued a comprehensive booklet describing in full and illustrating the process of manufacture, the buildings and machinery and the quality of the cement brick made by them. The booklet was prepared by W. P. Cosgrove, Indianapolis, and shows care and experience in preparing such literature.

The company uses the famous Utica or Ottawa silica fire sand and Utica cement, which are mixed and ground in one operation, then pugged, receiving the required moisture, then pressed and subjected to a special cement curing treatment, after which the bricks are ready for the wall.

Crushing tests by various engineering laboratories show ultimate strength of 5,692 to 7,668 pounds per square inch, most of the results lying between 6,250 and 6,625 pounds. Absorption is between 7 and 8 per cent. after 48 hours' soaking. Freezing tests, 20 freezings varying in length from 7 to 39 hours, showed almost infinitesimal losses in weight, the greatest loss in any one brick being less than one-third of 1 per cent., and some showing as low as one-twentieth of 1 per cent. The company will send copies of the booklet on request.

Waterproofing a Reservoir.

The Bedford reservoir at Pittsburg has an area of surface to be waterproofed amounting to 5,615 square yards. After the first layer of concrete, 4 inches thick, was laid and had become perfectly dry all dust was carefully brushed off and a heavy coat of Pioneer primer paint, made by the American Asphaltum and Rubber Co., of Chicago, was applied with ordinary paint brushes. On this primed surface was mopped a heavy coating of Pioneer reservoir waterproofing asphalt, applied at a temperature not less than 450 degrees F., to a thickness not less than one-eighth inch. Over each joint in the concrete was laid a single layer of asphalt saturated wool felt, 8 inches or more in width, which was laid in hot asphalt and then mopped carefully and heavily with the waterproofing asphalt.

After the waterproofing asphalt cooled

the next layer of 4 inches of concrete was laid, and this layer was waterproofed. Then a granolithic finish was laid on the exposed or finished surface by the alternate block method.

The accompanying photograph shows the first set of blocks laid and the workmen beginning the laying of the alternate blocks. Other workmen are applying asphalt on the side slopes of the reservoir.

Trade Publications.

The latest issue of *The Edison Aggregate* gives a number of photographs of beautiful concrete homes in cement stucco, poured concrete, concrete and stucco, and reinforced concrete.

Publication 387 of the National Brake and Electric Co. is devoted to motor-driven air compressors, type 3Vs.

Vulcanite Pamphlet No. 9 contains the article on "Uses of Mineral Oil Mixed Concrete," by Albert Moyer, which appeared in the February number of MUNICIPAL ENGINEERING.

The latest publication of the Association of American Portland Cement Manufacturers contains the progress reports of its committee on technical research on the action of oil on concrete and the effect of temperature on the hardening of concrete.

Bulletin No. 7 of the Adjustable Steel Centering Co. on methods of constructing monolithic concrete sewers, culverts and conduits is received.

Circular No. 17 of the International Exhibition of Railways and Land Transport, to be held in Buenos Aires, Argentine Republic, May to December, 1910, gives the program of the exhibition, fees and charges and much other information about the exhibition and the city.

Sewers, tanks and walls and their reinforcement when built of concrete are the subject of a booklet of the Northwestern Expanded Metal Co.

Specifications for Portland cement are issued by the American Bureau of Inspection and Tests.

The Lock Joint Pipe Co., 165 Broadway, New York, shows in a well-constructed booklet the Meriwether system of continuous reinforced concrete pipe. Howard Egleston, Chattanooga, Tenn., is sales manager for the Southern States.

The Cement Tile Machinery Co., of Waterloo, Iowa, sends an interest-compelling reminder of its factory, the machine it makes, and the tiles made by the machine.

The trade publication of the Crane Co., Chicago, is known as *The Valve World.*

Bulletin 69 of the Universal Portland Cement Co., shows many large buildings, chimneys, railroad structures and a dam in which Universal cement has been used.

The Economy Drawing Table Co., Toledo, O., sends a new catalog of the drawing tables, sectional filing cases and specialties in the same lines which they manufacture and which are so satisfactory to those who have purchased them.

Spiral riveted pipe and flanges for the same, hydraulic and exhaust steam supplies are described in pamphlet No. 30 of the American Spiral Pipe Works.

The Goheen Mfg. Co. issues an occasional new illustrated pamphlet on carbonizing coating.

Industrial Engineering and the Engineering Digest will be the name of the combination of the two papers included in the title, and the office will be at 220 Broadway, New York.

The monthly *Pipe Parley* of the McWane Pipe Works, Lynchburg, Va., announced the destruction of office and warehouse by fire on January 1, but as the works were not damaged the manufacture of pipe was not interrupted. Pipe prices are quoted at $26 a ton for 6-inch in New York and Birmingham.

The Bush type of train shed is fully described in a reprint from *Architecture,* entitled "A New Type of Train Shed."

The Scioto Fire Brick Co. issues an illustrated catalog of the many shapes and purposes of their fire brick.

The Barrett Mfg. Co. sends a handsome photograph of the new Pennsylvania railroad station, in which its specification pitch and felt have been used exclusively. Coal tar pitch and felt waterproofing which had been in the ground for thirty years were found in the buildings torn down for the station, and showed no change in chemical or waterproofing qualities.

Three valuable volumes on sewage collection and disposal are fully advertised in an illustrated circular of the Standard Sanitary Mfg. Co., Pittsburg.

The Mills memorial water works system of Thorntown, Ind., is described by Chas. Brossmann in a late booklet of the Lehigh Portland Cement Co.

The latest addition to German industrial literature is the monthly *Der Industriebau,* published by Carl Scholtze, Leipzig, which is devoted to the design and construction of factories, including all engineering structures and the technical matters connected therewith.

The last number of *Farm Cement News* issued by the Universal Portland Cement Co. devotes considerable space to cement exhibits at state fairs. Each fair should have a cement industries building in which the farmers can be instructed in the many uses of cement on the farm and the road. The movement for such buildings meets the approval of many who are interested in the advancement of agriculture.

Trade Notes.

ASPHALT.

Chehalis, Wash.—Special.—E. J. Hermans, cy. engr., advises us that he desires to purchase a municipal asphalt plant for a city of 8000.

Wichita, Kan.—Many of the citizens of this city advocate the purchase of a municipal asphalt plant.

Denver, Colo.—A contract for building a municipal asphalt plant has been awarded

WATERPROOFING BEDFORD RESERVOIR, PITTSBURG, PA.

to Hetherington & Berner, of Indianapolis, Ind., for $17,150.

BRICK.

Mt. Carmel, Ill.—The Mt. Carmel Vitrified Brick & Sewer Pipe Co. has been incorporated to manufacture paving brick and sewer pipe, by W. A. Stansfield, John E. Willis and J. S. Stansfield.

Ft. Wayne, Ind.—The Sprang Clay Products Co. has been incorporated to manufacture, buy and sell clay products, by Milo J. Sprang, Milo J. Gorrell, Jr., and A. J. Neireiter.

The Moores Coney Co., of Cincinnati, wholesale dealers in lime, cement and brick and builders' supplies, have purchased the controlling interest in the Harris Brick Co., at Zanesville, O., and an entire new line of brick machinery is being installed to manufacture the Harris Pavers. The plant should be in operation about April 1. Mr. Ellsworth Ogden, of Columbus, who has had a wide experience in the brick business, is in charge of the reconstruction, and will remain in charge of the plant. Mr. Peter Gorter will have charge of the sales department. The plant is located on the Belt Line with direct connection with the B. & O., Hocking Valley, Pennsylvania and the Wabash systems, thus conferring the best shipping facilities.

CEMENT.

Chamberlain, S. D.—The Dakota Portland Cement Co. will begin the erection of a plant for the manufacture of cement on March 15.

Keokuk, Iowa.—The Keokuk & Hamilton Water Power Co. has begun the erection of a cement plant at Hamilton, Ill.

CONCRETE BLOCKS.

Louverne, Minn.—The Louverne Concrete Co. has been incorporated by L. E. Coss, Dr. C. L. Sherman, C. J. Martin, H. E. Cornish, H. E. Peterson and E. R. Coss. H. E. Cornish is manager.

Humboldt, Ia.—The Humboldt Cement Products Mfg. Co. is erecting a cement block plant.

PURCHASE OF MACHINERY.

Perkasia, Pa.—Special.—A. M. Bean, mayor, says the borough council has passed a resolution to purchase a power road roller.

Trenton, N. J.—Special.—T. J. McGovern, general contractor, Fischer Bldg., desires prices and information regarding street cleaning machinery and up-to-date sweepers.

Tama, Ia.—Special.—D. F. Coe is in the market for a second-hand steam engine, 4 or 6 h. p.

Houston, Tex.—Special.—C. S. Woods, prest. Western Land Corporation, desires to purchase a rock crusher of 50 yds. daily capacity.

Montreal, Can.—Special.—Hilder Daw, C. E., 790 City Hall ave., is in the market for machinery and tools for constructing, and materials for building.

Normal, Ill.—This city has purchased four fine machines for the street department from the Studebaker Mfg. Co., of South Bend, Ind., including a large dump wagon, a street sweeper, a street sprinkler, and a machine for refilling the sweeper broom.

Landor, Wyo.—Special.—J. C. Edsall is in the market for dump wagons to use with traction engines.

Edmonton, Can.—Special.—B. F. Mitchell, secy. Edmonton Engineering Society, Archibald Block, advises us that the Edmonton Engineering Society is open to receive catalogues, etc., from manufacturers.

Creston, Ia.—Special.—Thos. S. DeLay, cy. engr., says this town will shortly be in the market for an elevating grader suitable for street grading where it is necessary to load the dirt in wagons. He desires to communicate with the producers of such machines and with any parties who have a second-hand machine for sale. He also desires information regarding a combination traction engine and road roller with gas power.

Los Angeles, Cal.—Bids will be asked soon, by the board of supervisors, for furnishing 4 steam road rollers of 13½ tons each.

PURCHASE OF MATERIALS.

Lander, Wyo.—Special.—J. C. Edsall advises us that he is in the market for Portland cement.

Creston, Ia.—(Special)—Thos. L. De Lay, cy. engr., desires up-to-date information on the cost of quarrying and crushing rock for concrete and road building.

LIGHT, HEAT AND POWER.

Portland, Me.—The Hydro Power Co. has been incorporated to deal in engines, pumps, etc., by F. W. Hayden, of Randolph, Mass., and C. H. Tolman, of Portland.

SEWER PIPE.

Spokane, Wash.—Work on the big sewer plant to be erected by the Washington Brick, Lime & Sewer Pipe Co. will begin as soon as the weather is favorable. The company was recently organized with J. H. Spear as president and general manager; William M. Colby, vice-president; S. J. Coal, secretary; T. E. Redmond, treasurer; L. A. Spear, assistant manager.

MISCELLANEOUS.

Newton, O.—Special.—The sales department of the G. W. Parsons Co. will be consolidated with the home office in this city. Geo. F. Lambert and Geo. M. King, who represent the sales department, will maintain their residences in Des Moines and both parties can be seen at their homes or be called there by long distance phone after office hours.

Gerald Priestman has been employed by Merritt & Co., of Camden, N. J., as manager of sales for their department of hydraulic specialties. Mr. Priestman was formerly with Pugh & Hubbard, consulting engineers, of Philadelphia, and later sales manager for a well-known New York company.

Patents Concerning Cement Blocks, Bricks and Artificial Stone.

856,176. Composite Building Block. Jas. Muir, Springfield, Mass.

856,213. Mold for Making Concrete Blocks and Artificial Stone. Wm. A. Benton, Ft. Worth, Tex.

863,711. Device for Molding Vessels, such as Flower Pots and the Like. Conrardus Geraedto, Adrianus Blocks, Jr., and Wilhelmus Byvoet Az, Roermond, Netherlands.

866,175. Cement Brick Pressing Machine. Philip K. Young, Omaha, Neb.

867,427. Cement Gate Mold. Ira Shively and Jay Huber, Dexter, N. M.

870,370. Process for Making Artificial Stone and Concrete. Frank S. Lamson, Washington, D. C.

876,280. Concrete Block Machine. Frank Morcher, Tiffin, O.

877,870. Apparatus for Molding Artificial Stone Blocks (curb). Jas. W. Shone and John N. Rauber, Rochester, N. Y.

877,874. Mold for Cement Blocks. Stoyan Tsanoff, New York, N. Y.

877,996. 877,997. Concrete Building Block Wall. Frank M. Henry, Minneapolis, Minn.

878,417. Artificial Stone Machine. Thos. A. McMurtrie, Los Angeles, Cal.

878,542. Cement Block and Brick Machine. Solomon M. Kimble, Jackson, Mich.

878,945. Cement Block Machine. Ross Endsley, Marion, Ind.

879,066. Core for Building Blocks. Edward Rhodes, Dresden, O.

880,066. Concrete Sidewalk Block. Chas. Deez, Madison, Wis.

880,201. Apparatus for Molding Concrete and the Like. Chas. Dietrichs, Little Ferry, N. J.

880,495. Concrete Block Machine. Albert P. Barnes, Neola, Iowa.

880,782. Face Plate for Cement Block Molds. Geo. W. Dunlap, Vancouver, B. C.

880,886. Machine for Making Cement Brick and the Like. Fred C. Hohn, Greencastle, Ind.

881,164. Press for Manufacturing Briquets, Blocks, Artificial Stone, and the Like. Wilhelm Surmann, Cologne, Germany.

881,224. Corner Lock for Cement Molds. Hugh A. Carmichael, West Lorne, Ont., Can.

881,513. Cement Block Machine. John Wengs, Monroe, Mich.

881,815. Cement Brick Machine. Daniel H. Merritt, Lincoln, Neb.

882249. Cement or Concrete Block Mold. Arthur M. Haight, Jackson, Mich.

882,414. Hollow Concrete Block. Herbert N. Pettigrew, New Orleans, La.

882,633. Building Block and Manner of Assembling. Robert A. Harris, Tucson, Ariz.

882,975. Process for Manufacturing Artificial Stone. Jacob Standt, Bonn, Germany.

883,294. Transporting and Drying Car for Cement or Concrete Blocks. Sherwood M. Chase, Columbus, O.

884,101. Cement Block Machine. John W. Miller, Jackson, Mich.

884,166. Mold Plate for Concrete Construction. Ernest G. Kemper, Dallas, Tex.

884,498. Concrete Block. Jas R. King, Petersburg, Ind.

884,713. Machine for Molding Cement Blocks. Frank Cherny, Cleveland, O.

884,931. Mold for Making Cementitious Articles. Daniel A. Keogan, White Haven, Pa.

884,965. Mold. Elias M. Walker, Wichita, Kan.

885,065. Refractory Block for Building Purposes. Frederick B. Marion, Paterson, N. J.

886,124. Manufacture of Artificial Stone. John C. Henderson, Oakland, Cal.

886,252. Process for Hardening Artificial Stone. Erich Schwanenberg and Albert Rinne, Hanover, Germany.

886,404. Machine for Forming Building Blocks. Wm. Raab, Waterloo, Iowa.

886,877. Cement Chair Mold. Mathias Serrier, Edwardsville, Ill.

887,211. Cement Block. John S. Minton, Kearney, Neb.

887,398. Brick and Block Mold. Chas. W. Jones, Charlotte, N. C.

887,432. Mold for Building Blocks. Frank M. Sawyer, Charlotte, N. C.

887,565. Apparatus for Molding Articles from Cementitious Material. Alex. Zuberbuhler, Toronto, Ont.

887,814. Mold for Hollow Concrete Blocks. Levi S. Johnson, Sioux City, Iowa.

887,933. Concrete Block Mold. Bernard A. Tuller and Miles Bateman, Centerville, Iowa.

889,569. Concrete Composition for Building Material. Herman S. Albrecht, St. Louis, Mo.

889,633. Apparatus for Forming Artificial Blocks. Albert A. Pauly, Youngstown, O.

889,943. Apparatus for Laying Walls of Building Blocks. Clawson M. Maddox, Muncie, Ind.

890,629. Machine for Molding Concrete or Cement Brick. John S. Fish, South Bend, Ind.

890,187. Artificial Stone Machine. John A. Smalley, Des Moines, Iowa.

891,312, 891,313. Concrete Chimney Block and Concrete Block. John W. White, Spokane, Wash.

891,423. Machine for Forming Concrete Blocks. Jas. Ingells, Muskegon, Mich.

892,138. Cement Block Mold. Wm. A. Crew, Salisbury, Md

892,583. Cement Block Machine. Wm. S. Colvin, Hamilton, Kan.

894,089. Concrete Block Press Machine. Fred E. Wilkinson, Fairbury, Neb.

894,390. Down-Face Cement Block Machine. Geo. F. Newton, Kansas City, Kan.

894,744. Machine for Molding Concrete Blocks. Wm. H. Phillips, Columbus, O.

895,195. Press for Pressing Concrete Into Blocks. Enos S. Redmond, Kansas City, Mo.

895,243. Interlocking Concrete Curb Block. Sydney L. Davis, Pensacola, Fla.

895,414. Block Molding Machine. Russell B. and Wm. W. Bennett, Westerville, Ohio.

895,614. Block Molding Machine. Ole Benson, South Omaha, Neb.

896,259. Cement Block Machine. Cyrus S. Wert, Kendallville, Ind.

896,330. Mold for Concrete Building Blocks. Christian J. Scheelky, Newport News, Va.

897,552. Cementitious Building Block Edward H. McClintock, West Somerville, Mass.

898,656. Building Block. Roy E. Keagle, Lodi, Cal.

898,703. Manufacture of Stone or Marble Artificially. Thomas M. Thorn, Woodlands, Chestnut, England.

898,911. Concrete Molding Device. Wm. C. Neeley, Pueblo, Col.

899,168. Machine for Molding Blocks. Julius Jaeger, Rutherford, N. J.

899,517. Block Molding Machine. Elmore N. Edwards, Alva, Okla.

899,799. Apparatus for Forming Building Blocks and Artificial Stone From Plastic Material. A. A. Pauly, Youngstown, Ohio.

900,272. Machine for Constructing Hollow Concrete Building Blocks. John Fish, South Bend, Ind.

900,414. Centrifugal Block Machine. Menzo Nashold, Davis Junction, Ill.

900,753. Building Block. Adam G. Mahler, Medford, N. Y.

900,910. Cement Block Machine. Geo. W. Buck, Omaha, Neb.

901,296. Machine for Making Blocks, Plates, Etc., From Plastic Materials. Chas. M. C. Hughes and Thos. H. Quinlan and Robert Middleton, London, Eng.

901,536. Artificial Stone Sewer Cap. Edward F. Kennelly, Boston, Mass.

901,740. Cement Block Machine. Geo. L. Reed, Springfield, O.

901,798. Concrete Construction (Block). Miner E. Fenner, Durand, Ill.

901,825. Concrete Block Machine. Arthur Pierce, Seville, O.

902,922. Portable Concrete Mold. David W. Smith, Ft. Worth, Tex.

903,477. Roofing Tile (Cement). Samuel A. Jones, Deshler, O.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Knoxville, Tenn.—The construction of a sample of pike road on Rutlidge pike is contemplated during this year.

Tacoma, Wash.—This city expended $670,594 during 1909 for the construction of 13.61 mis. of paved street, of which 10.04 mis. were asphalt; 1.05 mi. brick; about 2 mis. sandstone.

CONTEMPLATED WORK.

Spokane, Wash.—Plans have been completed for grading.

Eldora, Ia.—About 1 mi. of concrete paving is contemplated.

Paragould, Ark.—Paving is contemplated for the business streets.

Ft. Worth, Tex.—The city comrs. will pave 24 streets this year.

Olympia, Wash.—Brick paving is contemplated for Main st. this spring.

Toppenish, Wash.—About 10 blocks of paving is contemplated this spring.

Pontiac, Ill.—Brick paving is contemplated for Prairie st. and an alley.

Pasadena, Cal.—The construction of cement sidewalks in Pearl st. is contemplated.

DePere, Wis.—Council is considering a resolution to pave George st. with concrete.

Salt Lake City, Utah.—Council has passed ordinances for paving Fourth West st.

Sweetwater, Tex.—Vitrified brick paving is contemplated for 6 blocks of streets.

Vancouver, B. C.—Bids will be asked for constructing 10 mis. of cement work.

Des Moines, Ia.—Ordinances have been passed for paving 31st, Chester and 16th sts.

Carmi, Ill.—Concrete walks are contemplated. R. Vieler, chm. bd. local impvts.

St. Charles, Mich.—Will vote April 10 on the issue of bonds for road improvements.

Mt. Pleasant, Ia.—Paving is contemplated for about 3 mis. of paving this year.

Omaha, Neb.—The estimated cost of paving S. 13th st. with brick block is $59,529.

Sparta, Wis.—Council will take action Mar. 1 on repaving Water st. with vitrified brick.

Benton, Tex.—Macadam paving is contemplated for E. Hickory st. Z. Wiggs, cy. engr.

Canton, Ill.—Plans are being prepared for paving S. 1st ave. with brick. Jos. Waugh, cy. clk.

Marion, Ia.—Estimates are being prepared for brick paving. T. J. Cleveland, cy. clk.

Ida Grove, Ia.—About 1 mi. of asphalt paving is contemplated. Geo. C. Hubbard, cy. clk.

Osceola, Ia.—About 1,000 yards of vitrified brick paving is contemplated. W. Temple, cy. clk.

Hastings, Neb.—Will vote Mar. 8 on issue of $50,000 bonds for paving the street intersections.

Key West, Fla.—Will vote April 12 on the issue of $192,000 bonds for municipal improvements.

Eagle Grove, Ia.—Bids will probably be received in March for paving with brick. S. Middleton, cy. clk.

Waco, Tex.—Brick paving is contemplated for S. 4th, 5th, Washington and Franklin sts. Address mayor.

Ottawa, Ill.—Estimates have been prepared for paving in South Ottawa, West Ottawa, and Center Ottawa.

Beeville, Tex.—This city council is preparing to complete 15 mis. of street construction this year.

Manitowoc, Wis.—Bids will be asked soon for paving Washington, Main, Jay, Quay, Commercial and 9th sts.

Mankato, Minn.—Bids will be asked during March for paving 2nd st. with brick. John Wilson, cy. engr.

Seattle, Wash.—Plans are being prepared for regrading the district between 5th ave., Denny Way and Westlake ave.

Michigan City, Ind.—Plans have been completed for brick paving in Hermitage ave. H. M. Miles, cy. engr.

Ocean Park, Cal.—Asphalt resurfacing is contemplated for the Speedway, and concrete sidewalks for Florence ave.

Evansville, Ind.—Bids will be asked for paving Powell ave. and Tennessee st. with brick. Emil Pfafflin, cy. engr.

Clarinda, Ia.—Final action will be taken Mar. 5 on curbing and paving Chestnut and other streets with concrete.

Oneonta, N. Y.—The city engineer has been directed to prepare plans for paving upper Main and Chestnut sts.

Hartford, Conn.—The bd. of st. comrs. voted to construct ½ mi. of asphalt macadam road in Farmington ave.

South Bend, Ind.—A petition is being circulated asking that E. 4th, 3rd, Spring and E. Joseph sts. be paved.

Washington, Ia.—A petition has been submitted to council asking that Washington st. be paved to the city limits.

Muncie, Ind.—Plans and specifications will be prepared for paving Kilgore ave. and York Twp. pike with brick.

Oil City, Pa.—Plans have been prepared for about 60,000 sq yds. of paving with curbing. G. F. Roess, cy. engr.

Kearney, Neb.—Petitions are being circulated for paving 50 blocks of streets with brick block. Mayor Patterson.

Wausau, Wis.—Plans are being prepared for 9,300 sq. yds. creosoted wood block paving in 3rd st. B. C. Cowen, cy. engr.

Huntington, Tenn.—Voted to issue $10,000 bonds for street improvements, electric lights and water mains in the East End.

Benicia, Cal.—Final specifications have been adopted for paving Main and other streets; and a bond election will be called.

Sheridan, Wyo.—A committee has been appointed by city council to investigate the question o fpaving the principal streets.

Salt Lake City, Utah.—The city council has decided to construct 3 mis. of side-

walks in the northwestern section of the city.

Fairfield, Ill.—Plans have been prepared for paving Center st. John Moreland, engr.; H. W. Pitner, men. bd. local impvts.

Wenatchee, Wash.—The city council has taken steps toward forming an improvement district for grading, macadamizing, curbing, etc.

Beloit, Wis.—A contract will be let within 60 days for paving Prairie and Euclid aves. and 8th and Cross sts. B. E. Wood, cy. clk.

Bloomington, Ill.—City engineer Folsom has been directed to prepare plans and estimates for paving W. Washington st. with brick.

Toronto, Ont.—C. H. Rust, cy. engr., has recommended the construction of asphalt block paving in College st. as a cost of $52,619.

Elgin, Ill.—Spring st. will probably be paved with brick during 1910 at a cost of $61,000; Walnut ave., $45,000; S. State st., $22,000.

Benicia, Cal.—Final specifications have been adopted and the city trustees will pass resolutions calling for a bond election to vote on the issue of $100,000 bonds for paving Main and other streets.

Jamestown, N. Y.—A resolution has been adopted for paving Taylor st.

El Campo, Tex.—E. H. Koch has been elected president and W. A. Hiddleston secretary of an association formed to secure good roads and drainage.

Lowville, N. Y.—A resolution has been adopted approving plans and specifications for the county highway to be constructed from Harrisburg here.

Oakwood, O.—Macadam paving is contemplated for the pike leading into this village, by the county commissioners. Kenneth Allen, cy. engr., is interested.

Los Angeles, Cal.—Homer Hamilton, cy. engr., has been directed to prepare ordinances for improving a number of miles of streets with asphalt and macadam.

Hamtramck, Mich.—Plans have been completed for 14,000 sq. yds. of brick paving, and bids will be asked about Mar. 1. Harry M. Jacobs, vil. clk., Detroit.

Mt. Vernon, Wash.—J. E. Schauber, chm. Commercial Club com. on paving, is collecting information regarding paving, preparatory to paving the entire business section of this city.

Binghamton, N. Y.—The city engineer has been directed to prepare plans and specifications for brick paving in Alice st.; brick and wood block paving in Main st.; brick and asphalt paving in Front st.

Everett, Mass.—Mayor Bruce has recommended more granite block paving on concrete base, more brick paving, and an investigation of the merits of dust-laying application. Chris. Harrison, cy. engr.

Fremont, Neb.—The construction of good roads is urged by the Commercial Club. R. B. Schneider, M. G. Perkins, D. V. Stephens, and B. W. Reynolds have been appointed to co-operate with the Commercial Club.

Quincy, Ill.—A petition has been submitted to city council asking that the streets between Vermont and Jersey and 3rd and 8th be resurfaced with such material as may meet with the approval of the bd. of local impvts.

Glasgow, Ky.—(Special). J. U. Rogers advises us that the prospect of expending $3,000 to $5,000 annually in constructing streets, beginning in the early spring and summer and continuing until all streets, about 12 mis., are paved, is bright.

Houston, Tex.—A new paving plan has been adopted by the citizens on Travis st., who have asked that the street be paved for a distance of three blocks with shell, and agreeing to pay their pro rata for the paving as soon as the work is completed.

Chicago, Ill.—Albert F. Keeney, president; Chas. A. V. Standish, secretary, and Felix A. Norden of the bd. of local impvts., visited New York City and Washington recently to inquire into the success of creosoted wood blocks as a paving material.

Washington, D. C.—Plans have been perfected by the Washington-Alexandria Greater Highway Association to finance the proposed Washington-Alexandria highway. A macadam roadbed, 11 in. thick with a tar or asphalt binder, is proposed, at a cost of about $10,000.

Trenton, N. J.—(Special). T. G. McGovern, general contractor, advises us that this city is about to advertise for bids to clean and reface all paved streets by contract by the sq. yd. He desires information regarding the same and is ready to receive prices on machinery and up-to-date sweepers.

Eveleth, Minn.—The city engineer has estimated the cost of paving Grand ave. as follows: Tar macadam with cement base, $21,530; Telford macadam, $26,040; creosoted block with concrete base, $36,738 and tar macadam with crushed rock base, $20,777. He will prepare an estimate of the cost of cement paving.

Stockton, Cal.—The highway com'n has ordered plans and specifications prepared for road improvements, as follows: Cherokee Lane to Eight-Mile House, a distance of 8 miles; Waterloo Road, a distance of 7 miles; Linden Road, a distance of 12 miles; French Camp Road, 10 miles; Mariposa Road, 12 miles, and West Side Road, a distance of 23 miles; approximate cost, $700,000.

CONTRACTS TO BE LET.

Cincinnati, O.—Bids are asked until Mar. 4 for improving the Nelson road. Bd. co. com'rs.

Montgomery, Ala.—Bids are asked until Mar. 7 for paving Monroe st., Jeff Davis ave. and other streets, and constructing sidewalks in Maury st. Robt. Tait, cy. treas.

McKeesport, Pa.—Bids are asked until Mar. 8 for improving upper Walnut st. Cy. Engr. Smith.

Logansport, Ind.—Bids are asked until Mar. 7 for constructing a road. Geo. W. Cann, co. audt.

Racine, Wis.—Bids are asked until Mar. 5 for paving Racine st. with brick on concrete. B. P. W.

Laporte, Ind.—Bids are asked until Mar. 12 for constructing two roads. C. H. Miller, co. audt.

Brazil, Ind.—Bids are asked until Mar. 11 for constructing a gravel road. J. L. Burns, co. audt.

Richmond, Ind.—Bids are asked until Mar. 10 for grading and graveling. F. R. Charles, cy. engr.

Carmi, Ill.—Bids are asked until Mar. 7 for paving various streets with brick. Bd. local impvts.

Fowler, Ind.—Bids are asked until Mar. 8 for constructing 15 gravel roads. Lemuel Shipman, co. audt.

Kokomo, Ind.—Bids are asked until Mar. 9 for constructing gravel roads. A. B. Easterling, co. audt.

Muncie, Ind.—Bids are asked until Mar. 9 for constructing a public highway. Jos. E. Davis, co. audt.

Fairmont, Minn.—Bids are asked until Mar. 4 for constructing state road No. 1. H. P. Edwards, co. audt.

Greensburg, Ind.—Bids are asked until

Mar. 7 for constructing a macadam road. Frank E. Ryan, co. audt.

Wabash, Ind.—Bids are asked until Mar. 8 for constructing a gravel road. J. P. Noftzger, co. audt.

Columbus, Ind.—Bids are asked until Mar. 7 for constructing a macadam road. John M. Davis, co. audt.

Vincennes, Ind.—Bids are asked until Mar. 8 for constructing four gravel roads. John T. Scott, co. audt.

Peru, Ind.—Bids are asked until Mar. 9 for constructing three gravel roads. Chas. Griswold, co. audt.

Gordon, Ala.—Bids are asked until Mar. 15 for constructing 51 mis. of gravel road. W. J. Parish, co. audt.

Oklahoma City, Okla.—Bids are asked until Mar. 7 for constructing 21 mis. of additional paving. Cy. Engr. Burke.

Hartford City, Ind.—Bids are asked until Mar. 7 for constructing two gravel roads. L. W. Daugherty, co. audt.

Portland, Ore.—Bids are asked until Mar. 4 for constructing a boulevard. Cy. audt.

Olympia, Wash.—Bids are asked until Mar. 8 and 16 for macadamizing state aid roads. Henry L. Bowlby, secy. state highway bd.

Petersburg, Ind.—Bids are asked until Mar. 8 for constructing two rock roads. Frank R. Bilderback, co. audt.

Toledo, O.—Bids are asked until Mar. 4 for grading, draining and macadamizing a road. C. J. Sanzenbacher, co. audt.

Ft. Wayne, Ind.—Bids are asked until Mar. 2 for constructing "Goetin" stone road. Geo. H. Lindsmith, co. audt.

Ottawa, Kan.—Bids are asked until 5 p. m. Mar. 2 for graveling, curbing, guttering and macadamizing a number of streets; and also for paving them with vitrified brick and Imperial paving. A. H. Slater, mayor; F. A. Marcell, cy. clk.

Crawfordsville, Ind.—Bids are asked until Mar. 8 for improving a public highway. Bennett B. Engle, co. audt.

Marion, Ind.—Bids are asked until Mar. 7 for constructing macadam and brick roadways. A. Y. Stout, co. audt.

Tipton, Ind.—Bids are asked until Mar. 7 for constructing six gravel or stone roads. J. E. Barlow, co. audt.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing certain road and walks. Capt. P. Whitworth, Q. M.

Crown Point, Ind.—Bids are asked until Mar. 7 for constructing a number of gravel roads. C. A. Johnson, co. audt.

Tipton, Ind.—Bids are asked until Mar. 4 for constructing cement sidewalks, curb and gutter. W. Clyde Howard, cy. clk.

Pensacola, Fla.—Bids are asked until Mar. 10 for constructing 635,000 sq. ft. of concrete sidewalks. L. Earle Thornton, cy. engr.

Caney, Kan.—Bids are asked until Mar. 14 for paving Main, 9th, Spring and other streets with brick. R. V. Dodson, cy. clk.

Pittsburg, Pa.—Bids are asked until Mar. 8 for paving Walnut st. in Versailles twp. with brick. R. J. Cunninghom, co. audt.

Waseca, Minn.—Bids are asked until Mar. 9 for constructing 118,916 sq. ft. of paving and 7,428 ft. of curbing. John Madigan, cy. clk.

Dothan, Ala.—Bids are asked until Mar. 7 for constructing 14,000 sq. yds. of wood block, brick bitulithic and asphalt paving. Joe Baker, mayor.

Burlington, Wis.—Bids are asked until Mar. 15 for constructing 10,321 sq. yds. of brick paving and 2,500 lin. ft. of cement curb. P. J. Hurtzen, cy. engr.

Gallitzin, Pa.—Bids are asked until Mar. 5 (extension of date) for constructing about 9,000 sq. yds. of brick paving. Harry F. Conrad, boro secy.

Corydon, Ia.—Bids are asked until April 4 for constructing one-quarter of the road work for the year 1910. J. A. Wade, clk. twp. of Smith Fork.

Indianapolis, Ind.—Bids are asked until Mar. 7 for furnishing 400 tons of asphalt for use at the city asphalt repair plant. C. A. Schroeder, pres. B. P. W.

St. Paul, Minn.—Bids are asked until Mar. 7 for grading and macadamizing Centerville, Lexington ave. and Bald Eagle Lake ave. roads. E. C. Krahmer, co. audt.

Paoli, Ind.—Bids are asked until Mar. 8 for constructing 12,379 ft. of gravel or macadam roads. Wm. O. Hardman, chm. co. com'rs; Abraham B. Han, co. audt.

Oxford, N. C.—Bids are asked until Mar. 7 for constructing 20 mis. of county roads to include 3,000 cu. yds. of brick, vitrified pipe culverts. J. A. Osborne, co. engr.

Raleigh, N. C.—Bids are asked until Mar. 30 for constructing 25,000 sq. yds. of brick, bitulithic and asphalt macadam paving in Fayette and other streets. Wm. W. Wilson, cy. clk.

Ashland, O.—Bids are asked until Mar. 5 for macadamizing 3¼ mis. of roads requiring 23,900 cu. yds. of excavation and 22,015 sq. yds. of gravel macadam roadway. T. Brindle,, engr.

Canton, O.—Bids are asked until Mar. 22 for constructing about 12,300 lin. ft. of curb and 61,120 sq. ft. of flagstone walks in S. Dewalt and N. and S. Clarendon ave. P. H. Weber, cy. engr.

Corning, N. Y.—Bids are asked until Mar. 17 for constructing ½ mi. of brick paving and ½ mi. of bituminous macadam paving, with cement curb and gutters. W. C. Sleight, clk. B. P. W.

Menasha, Wis.—Bids are asked until Mar. 14 for paving Taylor, Racine and other streets with Portland cement. Separate bids will be received for paving between car tracks. Cy. clk.

Oshkosh, Wis.—Bids are asked until Mar. 3 for grading, curbing and repaving several streets with brick, creosoted blocks, cement, Blome patented granitoid, concrete, rock asphalt, sheet asphalt, or tar macadam. B. P. W.

Grand Forks, N. D.—Bids are asked until Mar. 7 for paving in districts Nos. 11, 14, 12, 13 and 16 with sheet asphalt, treated wood block, tar macadam or Donnellite, bitulithic or Blome granitoid concrete blocks. W. H. Alexander, cy. audt.

CONTRACTS AWARDED.

Peoria, Ill.—James S. Allen was awarded the contract for paving Hayes ave. with brick for $2,317.76.

Rossville, Tenn.—The contract for constructing a boulevard was awarded to the Noll Construction Co. for $419,650.

Anadarko, Okla.—The J. F. Hill Co. has been awarded a contract for more than 100,000 sq. yds. of brick and asphalt paving.

Birmingham, Ala. — (Special). The Southern Bitulithic Co. secured a contract for 75,000 sq. yds. of bitulithic pavement.

Newark, N. J.—(Special). The Standard Bitulithic Co. was awarded the contract for 50,000 sq. yds. of asphalt repairs.

Norman, Okla.—The contract for paving Main st. with Ardmore rock asphalt was awarded to the Parker-Washington Co. of St. Louis.

St. Paul, Minn.—The contract for constructing 400,000 ft. of walks and 1,500 cu. yds. of masonry was awarded to the Portland Stone Co.

Portland, Ore.—(Special). The Warren Construction Co. has been awarded the contract for 3,950 sq. yds. of bitulithic pavement in 1st st.

Spokane, Wash.—A contract for paving Lincoln st. was awarded to the Barber Asphalt Paving Co. for $50,930, and maintenance $1,305.

Knoxville, Tenn.—Horace A. Mann, of this city, secured a contract for constructing several miles of pike roads in McMinn county.

Portland, Ore.—(Special). A contract for constructing 21,629 sq. yds. of bitulithic paving has been awarded to the Warren Construction Co.

Goldsboro, N. C.—(Special). The Atlantic Bitulithic Co. has been awarded a contract for constructing 50,000 sq. yds. of bitulithic paving.

El Paso, Tex.—(Special). The Texas Bitulithic Co. was awarded the contract for 10,602 sq. yds. of bitulithic paving in S. Stanton st.

Marianna, Ark.—The contract for more paving was awarded, Feb. 15, to Contractor Petty.

Omaha, Neb.—Bids for paving and curbing in 14 districts were submitted, Feb. 15, by the following contractors: Omaha Cement Paving Co., Quannem-Decker Paving Co., Commercial Land Co., Grant Paving Co., C. E. Fanning, Hugh Murphy, E. D. Van Court, Bryant, Ford & McLaughlin, The Kettle River Co.

Ada, Okla.—The Shelby Downard Co., of Ardmore, was awarded the contract for constructing 13 blocks of paving at $1.80 a sq. yd. or $80,263.59.

Portland, Wash.—The Barber Asphalt Paving Co. was awarded a contract for paving for $374,000, and the Elwood Miles Co. a contract for $200,000.

Oconomowoc, Wis.—The contract for paving Collins and S. Main sts. with creosoted wood blocks was awarded to E. L. Bartlett, of Watertown, for $9,531.51.

Pekin, Ill.—The Springfield Cement & Construction Co., of Springfield, Ill., was awarded the contract for improving Capitol, Elizabeth, St. Mary and Sabella sts.

Cherryvale, Kan.—The contract for constructing ½ mi. of concrete curb and 4,500 sq. yds. of brick paving was awarded to John O'Leary, of this city, for $26,000.

Dallas, Tex.—(Special). The Texas Bitulithic Co. has been awarded a contract for constructing 23,085 sq. yds. of bitulithic paving in Cedar Springs st.

St. Louis, Mo.—(Special). The Granite Bituminous Paving Co. has been awarded a contract for 23,782 sq. yds. of bitulithic pavement in Connecticut ave., 22nd st. and Scanlan ave.

Omaha, Neb.—Dan Harmon was awarded the contract for paving B, C, J, 22nd, 20th and A sts. with brick block, and Jensen and Lefler the contract for paving 21st and 22nd sts. with brick block.

Alva, Okla.—(Special). A. K. Hubbard, cy. engr., says a contract has been awarded to C. A. Hemans, of Chickasha, for 15,230 sq. yds. of Trinidad sheet asphalt paving, with concrete curb and gutter, for $50,457.20.

Lewiston, Idaho—The city council has awarded a contract for paving Main st. with bitulithic for $42,465, and $10,525 for curbing and gutters. The construction company agrees to maintain the paving for the first 5 years at 2½ cents a yard annually, and the next 5 years at 2 cents a yard.

Creston, Ia.—(Special). The contract for constructing 25,000 sq. yds. of asphaltic macadam paving and 16,000 lin. ft. of cement curb was awarded as follows: Paving, Hamilton & Schwartz, of Shenandoah, Ia., $1.68 a sq. yd.; curbing, Miracle Concrete Construction Co., of Minneapolis, Minn., 34½ cts. a lin. ft.

Albany, N. Y.—Contracts for the improvement of public highways by state aid were awarded, Feb. 14, as follows: Road No. 323, Reservation-Ovid, Seneca Co., 3.86 mls., H. C. Schroeder, Rochester, $41,247; No. 350, Highland-Gardner, Ulster Co., 3.76 mls., General Construction Co., Bridgeport, Conn., $76,990; No. 5,000, Saugerties-Kingston, Ulster Co., 2.32 mls., John E. Consalus, N. Y. City, $24,685; No. 5,001, Lloyd Town Line-Milton, Ulster Co., 1.57 mls., General Construction Co., Bridgeport, Conn., $18,998; No. 397. Canajoharie-Flat Creek-Blaine, Montgomery Co., 6.67 mls., James E. Martin, Poughkeepsie, $73,454; No. 5,028, East Creek St. Johnsville, Montgomery Co., 3.75 mls.; Mohawk Engr. & Contr. Co., Schenectady, $62,980; No. 548, Berry Hill, Nassau Co., 7.59 mls., John F. Clancy, Astoria, L. I., $55,498; No. 610, Mechanicsville-Malta, Saratoga Co., 7.42 mls., Herlihy Contr. Co., Glens Falls, $87,308; No. 842, Waterford, Sec. 1, Saratoga Co., 0.27 mls., Kennedy & Easton, $3,294; No. 565, Watertown-Theresa, Sec. 1, Jefferson Co., 7.35 mls., Herlihy Constr. Co., Glens Falls, $81,850; No. 624, Carthage-Wilna, Jefferson Co., 3.09 mls., P. H. Murray, $35,185; No. 5,005, Black River-Watertown, Jefferson Co., 4.84 mls., P. H. Murray, Rochester, $59,400; No. 583, Couse-Lutha Rensselaer Co., 3.40 mls., W. M. Atchison, Troy, $37,154; No. 631, Eagle Mills-Clum's Corners, Rensselaer Co., 2.25 mls., Wm. Atchison, Troy, $23,676; No. 637, Manchester-Victor, Ontario Co., 5.30 mls., Hageman, Miller & Hageman, $48,517; No. 638, Geneva, Ontario Co., 1.02 mls., Frederick A. Brotsch, Jr., Rochester, $10,746; No. 724, Greenwich-Battonville, Washington Co., 3.98 mls., Herlihy Constr. Co., Glens Falls, $34,749; No. 5,033, Salem-Granville, Part 1, Washington Co., 2.96 mls., R. Hopkins, Troy, $28,300; No. 728, State Line-Orangeburg, Rockland Co., 2.82 mls., H. S. Herring, Jr., & Co., Hillsdale, N. J., $32,100; No. 5,002, Congress-Long Clove, Richland Co., 1.6 mls., H. B. Sproul, Peekskill, $17,289.

SEWERS.

CONTEMPLATED WORK.

Bellefontaine, O.—A sewerage system is contemplated.

Atlanta, Ga.—Voted to issue $1,350,000 sewer bonds.

Madison, Fla.—Plans are being prepared for a sewer system.

Sand Point, Idaho—Plans will be completed Mar. 1 for a sewerage system.

Tulare, Neb.—Will vote on issue of bonds for constructing a sewerage system.

Duluth, Minn.—Plans and estimates have been completed for the Woodland ave. sewer.

Spur, Tex.—Preliminary plans for a sewerage system will be made by John B. Hawley.

Tonawanda, N. Y.—A. P. Smith, cy. engr., has completed plans for a sewer in Rumbold ave.

Wymore, Neb.—Plans and specifications will be made for a municipal sewerage system.

Rochester, Minn.—A petition is being circulated, asking for storm sewers in W. College st.

Bowling Green, Ky.—The construction of a sewerage system is contemplated. G. E. Townsend, mayor.

Nevada, Ia.—Objections will be heard,

Mar. 21, to assessments in the Goose Lake drainage case.

Missouri Valley, Ia.—Bids will probably be received in March for constructing a sewerage system.

Hays, Kan.—Plans for a sanitary sewerage system will be made by the W. K. Palmer Co., engrs., Kansas City.

Momence, Ill.—About $30,000 will be expended in the construction of pipe and cement sewers. H. E. Vail, cy. engr.

Libby, Mont.—(Special). Montgomery G. Rice, town atty. and town clk., advises us that a sewerage system is contemplated.

Helena, Mont.—The residents in the Broadwater section have petitioned for the creation of a special improvement district in that section.

Hawarden, Ia.—A plan for a sanitary sewerage system will come up for final adoption Mar. 25. It provides for a septic tank system.

Michigan City, Ind.—The construction of a district sewer in Willard ave. is contemplated. Objections will be heard Mar. 8.

Lodi, Cal.—Plans have been accepted, and contracts will be let at once, for constructing a sewerage system. City trustees.

Leon, Ia.—Council will take final action Mar. 22 and 23 on the construction of more vitrified clay, tile or cement sewers in several streets.

Chehalis, Wash.—(Special). E. J. Hermans, cy. engr., desires information regarding concrete sewers as compared with clay products.

Vancouver, B. C.—Plans and specifications for a new sewerage system, to cost about $57,000, have been submitted. Mayor Huggins.

Des Moines, Ia.—Surveys are being made for a combined sewer system for a large area in East Des Moines. Geo. P. Poorman, cy. clk.

Hawarden, Ia.—The plan for a sanitary sewer system will come up for final adoption Mar. 25. The plan provides for a concrete septic tank.

Kansas City, Mo.—A complete topographical map of the proposed sewer system to drain 60 sq. mis., has been prepared by Jas. L. Darnell, cy. engr.

Chester, Pa.—Plans for a new sewerage system, including a disposal plant, have been submitted by Alexander Potter, cons. engr., of New York City.

Kennewick, Wash.—Preliminary steps have been taken by the city council for installing a modern sewerage system, and the work of construction will begin about April 1.

Gastonia, N. C.—Plans and specifications for the proposed septic tank at the sewer outlet on the city farm will be prepared by the Solomon-Norcross Co., Candler Bldg., Atlanta.

Albert Lea, Minn.—(Special). Wm. Barneck, cy. engr., says plans are now being prepared for a sewerage system covering the entire western part of the city. About 9,000 ft. of pipe sewers are contemplated this season.

Omaha, Neb.—The city council committee of the whole has authorized the city engineer to proceed with the building of the necessary sewers, to the full extent of the money available, about $48,000. About $10,000 of this amount will be devoted to catch-basins, intersection work, etc.

Washington, D. C.—The Bureau of Manufacturers; dept. of commerce and labor, has information regarding certain contracts, some to be let in a large foreign city in connection with the establishment of a drainage system. Specifications will be given out soon and bids received during a period of three months after the specifications are published. The value of the machinery will be about $500,000. In applying to the Bureau of Mnfrs., for address, refer to file No. 4,521.

Washington, D. C.—Asa Phillips, supt. of sewers, has outlined a plan providing for the organization of a metropolitan district of sewerage, to construct intercepters along Rock Creek and Anacostia river from the District Boundary several miles out into the suburbs, and giving the Maryland towns the benefit of this city's fine disposal system, in order to save the above streams from pollution.

CONTRACTS TO BE LET.

Eldora, Ia.—Bids are asked until Mar. 7 for constructing tile sewers. R. A. Vigars, co. audt.

Richmond, Ind.—Bids are asked until Mar. 10 for constructing sewers. H. M. Hammond, chm. B. P. W.

Huron, S. D.—Bids are asked until Mar. 4 for constructing 12,650 ft. of 8 to 15-in. sewers. Cy. audt.

Ashley, N. D.—Bids are asked until April 4 for furnishing metal culverts of various sizes. John F. George, co. audt.

Bluffton, Ind.—Bids are asked until Mar. 26 for constructing 2 ditches. Harvey B. Sark, supt. constr., co. surveyor's office.

Ft. Sill, Okla.—Bids are asked until Mar. 7. for constructing a sewerage and drainage system. Capt. David L. Stone, Constr. Q. M.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing storm sewers at Ft. Crockett. Capt. P. Whitworth, Q. M.

Cleveland, Tenn.—Bids are asked until April 1 for constructing a sewerage system and disposal plant. Sol Norcross Co., engrs., Atlanta.

Alliance, Neb.—Bids are asked until Mar. 2 for sewer work in 5 districts and a concrete septic tank. Cy. clk.

Vincennes, Ind.—Bids are asked until Mar. 2 for furnishing plans for a general sewerage system. Mayor McDowell.

Glen Osborne, Pa.—Bids are asked until Mar. 10 for constructing 6,145 ft. of 8 and 10-in. sanitary sewers, 18 manholes and a flush tank.

Sumner, Ill.—Bids are asked until Mar. 3 for digging, enlarging and grading a ditch 6 mis. long. Henry Matthias, chm. drainage com'rs.

Louisville, Ky.—Bids are asked until Mar. 4 for constructing section "A," Castlewood sewer, contract 61. P. L. Atherton, chm. com'rs sewerage.

Burlington, Wis.—Bids are asked until Mar. 15 for constructing 4,870 ft. of 6 to 12-in. vitrified pipe. 15 manholes, etc. P. J. Hurtgen, cy. engr.

Florence, S. C.—Bids are asked until Mar. 3 for constructing a system of sanitary sewers and a disposal plant. J. K. Gilbert, bd. sewer com'rs.

Madison, Fla.—Bids are asked until Mar. 16 for constructing a sanitary sewer system, comprising 6 mis. of 6 to 15-in. pipe sewer and a disposal plant. R. H. Rowe, mayor.

Syracuse, N. Y.—Bids are asked until April 1 for the Harbor Brook improvement, 5 mis. long, including the construction of an intercepting sewer. Intercepting sewer bd.

Champaign, Ill.—Bids are asked until Mar. 5 for constructing a drain tile in Sadorus twp. David Tracy, chm. drainage com'rs, East Lake Fork special drainage dist.

El Paso, Tex.—Bids are asked until Mar. 3 for constructing refuse incinerating and sewage pumping station, force main and sewage disposal works, with appurtenances; also furnaces, pumps and machinery. Percy McGorce, cy. clk.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for constructing the Arroyo de los Posos main sewer was awarded to Joe Chutuk.

Hill City, Minn.—The contract for the big Willow river ditch was awarded to the Kohler Constructing Co.

Kansas City, Mo.—The contract for constructing sewers in dist. No. 250 was awarded to Kinlen Bros., 3426 Michigan ave., for $13,208.

Omaha, Neb.—The contract for constructing sewer in Howard, Harney, 9th and 10th sts. was awarded to John J. Hannighen, for $15,800.

Webster City, Ia.—The contract for constructing 11½ mis. of sewer was awarded to the Tabor Construction Co., of Waterloo, for $32,000.

Montgomery, Ala.—The contract for constructing 5,900 ft. of sewer in O'Connelly and Thurman sts. was awarded to J. N. Mitchell, for $9,075.

Summit, N. J.—The contract for building sewer in Summit av. and Hill Crest was awarded to John C. Schrader, of Williamsport, Pa., for $4,871.

Kenmore, N. D.—The contract for constructing several blocks of sewer was awarded to G. V. Clark, at $1.34 for 12-in. and $1.20 for 10-in. sewers.

Chicago, Ill.—John W. Farley & Co., 134 Washington st., was awarded a contract, Feb. 2, for constructing a concrete conduit in W. 39th st., for $78,057.

Chicago, Ill.—The contract for constructing a conduit to drain the west arm of the south branch of the Chicago river was awarded to the J. W. Farley Co.

Charleston, S. C.—The contracts for constructing new sewerage extension, contracts A and B, were awarded to Guild & Co., of Chattanooga, at $27,822 and $80,672, respectively.

Omaha, Neb.—The contract for completing the Mud Creek and Jette Creek sewers was awarded to the Opperman Plumbing, Heating and Construction Co., 212 N. 25th st., South Omaha, for $140,000.

Grinnell, Ia.—Bids for constructing a sewer in North Grinnell have been submitted as follows: Guy F. Smith, Indianola, $5,232; C. E. Decatur, $5,248; The O'Farrell Construction Co., $5,335.

Erie, Pa.—The contract for constructing a sewer was awarded to Dennis O'Brien, at $1.20 a ft. for 15-in. and 35 cts. for 6-in. pipe, $1.40 for Y and T branches, and $40 for manholes.

Weatherford, Okla.—The bid of Marshall Bros., of Las Animas, Col., was the lowest submitted Feb. 11 for constructing a sewerage system, at $33,807.50, and the contract was awarded them.

Provo, Utah—The James Kennedy Construction Co., of Salt Lake City, submitted the lowest bids, Jan. 24, for constructing sewers, as follows: No. 12, 55,083 ft., $85,661; 1,176 ft. 24-in. sewer to provide outfall for sewer district No. 12, $3,737.

Salt Lake City, Utah—(Special)—Contracts for sewer extensions were awarded to the James Kennedy Construction Co. as follows. No. 220, $134,287.10; No. 249, $33,730.23; No. 253, $587.97; No. 254, $714.54. P. J. Moran was awarded the contract for constructing the City Creek aqueduct, for $25,192.08.

Seattle, Wash.—Sewer contracts have been awarded as follows: Augusta ave., J. C. Broad, $3,265; alley bet. Boone and Gardner, G. Burgie, $1,025; 5th ave., Lang & Smith, $660; alley bet. Baldwin and Ermina, G. Burgie, $5,000; 18th ave., John Fife, $10,000; Sound ave., Thos. Malony, $2,224; Lincoln st., Lang & Smith, $2,560.

Niagara Falls, N. Y.—Cusano & Dower, of this city, secured the contract for constructing a sewer in Portage road, as follows: 1,046 lin. ft. of 15-in. tile, $1.10; 1,258 lin. ft. 12-in. tile, 75 cts; 1,215 lin. ft. 10-in. tile, 65 cts; 14 manholes, each, $35; ten catchbasins, each, $35; 3,000 cu. yds. rock excavation, $2.75; total, $11,974. Other bids were: William Ruffran, Niagara Falls, $11,990; J. E. Beard, Buffalo, $13,416; George S. Nelson, Niagara Falls, $13,567; W. A. Shepard & Co., Niagara Falls, $12,426.

Niagara Falls, N. Y.—The contract for constructing a tunnel sewer in Cleveland ave. was awarded to the Read-Coddington Co., of this city, as follows: 1,230 lin. ft. of 7x9 ft. rock tunnel, $19.80; 160 lin. ft. 8x10 ft. shaft, $26; two shaft coverings, complete, $150; 100 cu. yds., overhaul, 10 cts; 40 lin. ft. 36-in. tile in concrete, $4; 15 lin. ft. 30-in. tile in concrete, $4; 20 lin. ft. 24-in. tile in concrete, $6; 85 lin. ft. 6-in. tile in concrete, 50 cts; 20 cu. yds. rubble masonry, $4; 20 cu. yds. rock excavation, $3; total, $29,347. George S. Nelson, of Niagara Falls, bid for this work $31,292.

Norfolk, Va.—F. J. McGuire was awarded a contract for constructing sewers in the streets in the Greater Ghent section, for $12,570.

WATER WORKS.

Chicago, Ill.—The Stockyards Water Co. has been incorporated, to operate a system of water works, by Horace C. Gardner, George W. Williams and Charles F. Penning.

CONTEMPLATED WORK.

Oroville, Wash.—A water works system is contemplated.

Swansboro, Ga.—A water works system is contemplated.

Brawley, Cal.—A water works system is contemplated.

Selden, Kas.—A water works system is contemplated.

Deering, N. D.—A water works system is contemplated.

Atlanta, Ga.—Voted to issue $900,000 bonds for water works.

Lonsdale, Tenn.—This town may build a water works system.

Jonesboro, Ill.—Will vote in April on the water works question.

Plainville, N. J.—A municipal water works system is contemplated.

Chester, Neb.—The installation of a water works system is contemplated.

South Bend, Ind.—The improvement of the water works system is contemplated.

New Athens, Ill.—The construction of a water works system is contemplated.

Gettysburg, S. D.—A water works system is contemplated. E. F. Gross, chm. com.

Pearsall, Tex.—A water works system is contemplated. R. W. Hudson is interested.

Geneva, N. Y.—The increase of the capacity of the water works system is contemplated.

LaCrosse, Wis.—A new water works system is advocated for this city. Ora J. Sorenson, mayor.

Cottage Grove, Ore.—The estimated cost

of the proposed gravity water works is $100,000.

Collingswood, N. J.—Will vote on the question of establishing a municipal water works system.

Charles City, Ia.—Will vote on the issue of bonds for extending the water works system.

Gilbert, Minn.—Bonds have been voted to complete the water works and electric light system.

Hood River, Ore.—Specifications are being prepared for a water works system. H. B. Langille, cy. recdr.

Liberal, Kan.—The Commercial Club is considering a proposition providing for a complete water works system.

Lorain, O.—The city council has authorized the issue of $50,000 bonds to extend the water works intake pipe.

Scandia, Kas.—Will vote Mar. 7 on the issue of $21,000 bonds to install an up-to-date system of water works.

Seattle, Wash.—Will vote Mar. 8 on the issue of bonds for enlarging and extending the city water supply system.

Centralia, Mo.—Plans are being prepared for constructing a water works and sewer system. A. Bishop Chance, mayor.

Ottumwa, Ia.—The purchase of the present water works plant or the construction of a new system is contemplated.

Lehigh, Okla.—(Special)—John Rogers advises us that he desires to purchase an electric pump of 350 gals. capacity.

Newport, Tenn.—An ordinance has been passed providing for the issue of $50,000 bonds for installing a water works system.

Monroe, Wash.—Bids will be received about April 1 for constructing a reservoir. R. V. Greene, supt. Monroe Water Co.

Coxsackie, N. Y.—The question of increasing and improving the village water supply is being disclssed by the Bd. of Trade.

Jacksonville, Fla.—The board of trustees have instructed the water committee to investigate the cost of constructing a reservoir.

Millersburg, Ky.—Plans for the construction of a water works system will be prepared by F. O. Siebert, 215 E. Main st., Lexington.

Eastman, Ga.—Will vote Mar. 15 on the issue of bonds for improving the water works system and building sewers. Dr. J. D. Herman, mayor.

Libby, Mont.—(Special) — Montgomery G. Rice, town atty. and town clk., advises us that the town has under consideration a water franchise.

San Bernardino, Cal.—Plans have been completed for replacing flumes on Fairbanks ranch with pipe, aggregating about 4½ mis. Wm. Brown, w. w. engr.

Lafayette, Ga.—The city council contemplates the construction of a water works system and invites correspondence. C. J. Hammond, cy. recdr.

Norwood, O.—An ordinance has been passed providing for the issue of bonds for water works improvements, including 2 new wells and additional piping.

Morgan City, La.—(Special)—Willard Ditch, secy. bd. of trade, says this city contemplates the erection of a water works plant in the near future.

Newport, O.—The Clifton District Trustees voted to issue $12,000 bonds for the purpose of constructing a water works system in the district.

Ashford, Ala.—(Special)—J. W. McIntry, mayor, advises us that the installation of a water works and light plant is desired in that town. Population 600.

Santa Barbara, Cal.—Will vote soon on the issue of $300,000 bonds to complete the municipal water works system, to include a tunnel, reservoirs and pumping station.

Defiance, O.—(Special)—John A. Foust, prest. city coun., says this city contemplates securing the services of a capable water and light expert to examine and investigate the conditions at the present plants and advise for the best interests of the city.

Quanah, Tex.—T. L. Fountain, of the engineering firm of Fountain & Shaw, of Houston, has investigated the available water supplies for this city, and reported to the city council. His plan contemplates the damming of South Groesbeck creek, keeping the water in a narrow canyon there, and pumping it through the pipes to the city.

Louisville, Ky.—The Louisville Water Co. has directed Theodore A. Leisen, 459 8th st., chf. engr., to prepare plans and estimates for improvements, as follows: A 30,000,000-gallon vertical steam turbine-driven centrifugal pump at river station No. 1, with necessary improvements and alterations to station; a concrete and stone intake crib and tower with screen chambers for supply in both stations Nos. 1 and 2, and connection for future station when required; cleaning Crescent Hill reservoir, cementing and grouting bottom and slopes of north reservoir and construction of weir tower and improvements to conduit between reservoirs; new stable and other changes and additions to buildings at Third st., and provisions for better facilities in storing coal at Crescent Hill pumping station.

CONTRACTS TO BE LET.

Midland, Tex.—Bids are asked until Mar. 7 for constructing water works. H. B. Dunnegan, cy. secy.

Phœnix, Ariz.—Bids are asked until Mar. 14 for furnishing a pumping engine. Robt. A. Craig, supt. water bd.

Burlington, Wis.—Bids are asked until Mar. 15 for the extension of the water works system. P. J. Hurtgen, cy. engr.

Ft. Sill, Okla.—Bids are asked until Mar. 7 for constructing water works, sewers and drains. Capt. David L. Stone, Q. M.

Aberdeen, S. D.—Bids are asked until Mar. 14 for 4 and 6-in. c. i. pipe and other water supplies. F. W. Raymond, cy. audt.

Ft. Morgan, Ala.—Bids are asked until Mar. 7 for constructing 3 reinforced concrete cisterns. Capt. H. B. Chamberlain, Q. M.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing a water works distributing system here. Capt. P. Whitworth, Q. M.

Roslyn, Wash.—Bids are asked until Mar. 7 for furnishing flanged spiral riveted steel pipe and straight steel pipe for gravity water system. Cy. clk.

Vicksburg, Miss.—Bids are asked until Mar. 7 for laying 60 blocks of water mains in Cherry, Harris, Drummond and Walnut sts. J. J. Hayes, mayor.

Rock Island, Ill.—Bids are asked until Mar. 7 for a Holly pump, now at the pumping station, which this city will sell. M. T. Rudgren, cy. clk.

Portland, Ore.—Bids are asked until Mar. 8 for constructing a steel conduit 24 mis. in length from the head works to Mt. Tabor. Frank T. Dodge, supt. water bd.

Meadville, Pa.—Bids are asked until Mar. 7 for erecting a brick or cement chimney at the city pumping station. Henry Ellsworth, secy. water & ltg. dept.

Huron, S. D.—Bids are asked until Mar. 4 for constructing new c. i. water mains to replace the existing mains, and for the ex-

tension of said new iron water mains. Cy. audt.

Ft. Riley, Kas.—Bids are asked until Mar. 8 for constructing a boiler house and pump pit and installing a boiler, pumping engine and water main. Capt. W. M. Whitman, Constr. Q. M.

CONTRACTS AWARDED.

Weatherford, Okla.—The contract for water works extension was awarded to Kelly, Mayfield & Shaw, of Lawton, for $25,000.

Aurora, Ill.—The American Pipe Foundry Co., of Birmingham, Ala., was awarded the contract for 8,200 ft. of 6-in. pipe and 8 hydrants.

Quincy, Ill.—The contract for a 6,000,000-gal. pumping engine has been awarded to the Platt Iron Works, of Dayton, O., for $17,980.

Minneapolis, Minn.—The contract for erecting a steel tank and tower on Lowry Hill was awarded to the Chicago Bridge & Iron Co., for $6,350.

Takoma Park, Wash.—The contract for constructing a filter plant was awarded to the Pittsburg Filter Mfg. Co., of Pittsburg, Pa., for $7,110.

Portales, N. Mex.—The contract for constructing an irrigation system has been awarded to the Western Construction Co., of Wichita, Kas., for about $350,000.

North Platte, Neb.—The contract for furnishing c. i. tunnel linings for use at the Pathfinder dam, North Platte irrigation project, Nebraska and Wyoming, for $4,346, to be delivered at Casper, Wyo.

Bloomington, Ill.—Contracts amounting to $65,000 were awarded, Jan. 28, for the improvement and enlargement of the city pumping station. The Allis-Chalmers Co., of Milwaukee, was awarded the contract for a 6,000,000-gal. Corliss pump, for $21,600; Heine Mfg. Co., boilers, set complete, $9,052; Greene Eng. Co., stokers, $2,519; Gray & Bowman, tunnel, hydraulic lift, industrial track bunkers, elevated track, grading, etc., $10,474; Heine Chimney Co., chimney, $3,751; Frank Sullivan, outside piping, $6,359, and, same company, plumbing, $1,684. The pump contract has been held up and may be awarded elsewhere.

BRIDGES.

Topeka, Kas.—Bids are asked until Mar. 7 for the extension of the Melan arch bridge. Cy. clk.

Ann Arbor, Mich.—Bids are asked until Mar. 9 for constructing a new cement bridge. B. P. W.

Rochester, Ind.—Bids are asked until Mar. 7 for the repair of a bridge. Geo. W. DuBois, co. audt.

Martinsville, Ind.—Bids are asked until Mar. 8 for constructing 4 bridges. B. E. Thornburgh, co. audt.

Cincinnati, O.—Bids are asked until Mar. 11 for constructing a concrete bridge on Bogard road. Bd. co. com'rs.

Webster, N. C.—Bids are asked until Mar. 7 for building a steel bridge at Sylva. H. R. Queen, chm. co. com'rs.

San Jose, Cal.—Estimates have been submitted for constructing a reinforced concrete bridge over Coyote creek.

Brazil, Ind.—Bids are asked until Mar. 8 for constructing 2 steel bridges and 5 concrete bridges. J. L. Burns, co. audt.

San Diego, Cal.—The city engineer has been directed to construct a bridge over the San Diego river in Mission Valley.

Greenfield, Ind.—Bids are asked until Mar. 7 for constructing a new bridge with reinforced concrete. C. H. Troy, co. audt.

Boonville, Ind.—Bids are asked until Mar. 7 for constructing 25 steel bridges with concrete backing. Ray F. Cherry, co. audt.

Winnipeg, Man.—Bids are asked until Mar. 7 for constructing the Brant street bridge. M. Peterson, secy. bd. control.

Savannah, Ga.—Bids are asked until Mar. 14 for constructing a steel highway bridge over Heeb river. G. Reuben Butler, co. clk.

Laporte, Ind.—Bids are asked until April 4 for constructing bridge over Kankakee river at English Lake. C. H. Miller, co. audt.

Columbus, Ga.—This city voted, Feb. 12, to construct a new steel or concrete bridge over the Chattahoochee river. Mayor Browne.

Rochester, N. Y.—Plans for a concrete bridge over the Genesee river at Central ave. have been prepared by E. A. Fisher, cy. engr.

Des Moines, Ia.—A contract will probably be let early this spring for building a bridge at Walnut st. John W. Budds, cy. engr.

Kalama, Wash.—Bids are asked until April 5 for constructing a steel highway bridge at Castlerock, Wash. G. S. Roberts, engr., Kalama.

Birmingham, Ala.—Maury Nicholson, cy. engr., has been directed to prepare plans and specifications for constructing a subway viaduct on 19th st.

Edmonton, Alta.—Bids are asked until Mar. 12 for constructing all steel highway bridges required during 1910. John Stochs, deputy Minister Pub. Wks.

Bradentown, Fla.—Bids are asked until Mar. 7 for constructing 4 steel bridges over bays, rivers and creeks. Robt. H. Roesch, clk. co. com'rs.

Reading, Pa.—Bids are asked until Mar. 3 for constructing a reinforced concrete arch bridge in Wyoming borough. A. L. Rhoads, co. controller.

St. Louis, Mo.—Bids are asked until Mar. 15 for reconstructing the 18th st. bridge over Mill Creek Valley. Maxine Reber, prest. B. P. I.

Oxford, N. C.—Bids are asked until Mar. 7 for raising an 85-ft. steel span 16 ft. higher and building two 75-ft. steel spans. Jas. A. Osborne, co. engr.

Seneca Falls, N. Y.—An appropriation has been made for constructing a new bridge over the canal at Ovid st. Plans and specifications have not yet been prepared.

Hutchinson, Kas.—Bids are asked until Mar. 11 for constructing a reinforced concrete arch bridge over Cow Creek. Ed Metz, cy. clk.; G. L. McLane, cy. engr.

St. Joseph, Mich.—Bids are asked until Mar. 10 for constructing a substructure for a swing bridge on Wayne st. over Momsin Channel and the Michigan Central Ry. tracks. M. Weber, cy. clk.

Wichita, Kas.—The residents of this city will vote on the issue of $40,000 for constructing a concrete bridge across Little river at 11th st. and a concrete dam across Little river at or near Central ave.

STREET LIGHTING.

Devils Lake, N. D.—A new system of street lighting is proposed.

Altus, Okla.—Voted to issue bonds to construct an electric light system.

Ft. Wayne, Ind.—Bids are asked until Mar. 7 for installing a municipal lighting plant.

Pomona, Cal.—Plans have been prepared for extensive improvements to the street lighting system.

Toronto, Ont.—Bids are asked until Mar. 8 for furnishing underground cable. G. R. Geary, mayor.

Norwood, O.—An ordinance has been passed to issue $18,000 bonds for improving the electric light plant.

Edentown, N. C.—Plans are being considered for installing a unit in the municipal electric light plant. J. C. Martin, supt.

Louisville, Ky. — Specifications have been prepared calling for 80 copper standards, of the most modern type, to be placed in Main st.

Humboldt, Tex.—The Huntswiller Light & Power Co. has closed a contract with the Fairbanks-Moore Co. for a gas producer plant and dynamo.

Drain, Ore.—An ordinance has been passed providing that a contract be awarded to the Drain Electric Light & Power Co. for a term of 20 yrs.

Green Bay, Wis.—Bids are asked until Mar. 15 for furnishing and installing electric fixtures in the new Court House. Paul Schuering, co. suyr.

Pittsburg, Pa.—The contract for incandescent lighting in the city thoroughfares has been awarded to the Sunlight Illuminating Co., 6302 Penn. ave.

Orange, Tex.—Frank D. Moses, of Trenton, N. J., has been investigating conditions here with a view of securing a franchise and establishing a gas plant.

Libby, Mont.—(Special)—Montgomery G. Rice, town atty. and town clk., advises us that the town board has under consideration an electric light franchise.

Minneapolis, Minn.—City council voted, Feb. 11, to instruct city clerk Knott to notify the Minneapolis Gas Light Co. that the city desires to purchase its plant and franchise.

Sierra Madre, Cal.—Bids are asked until Mar. 15 for the sale of a franchise to construct a gas plant and supply this city with gas for a period of 50 years. J. A. Madden, clk.

Indianapolis, Ind.—Bids are asked until Mar. 16 for furnishing and laying complete all electric lighting or gas lighting fixtures in the new City Hall. C. A. Schroeder, pres. B. P. W.

Wheeling, W. Va.—Bids are asked until Mar. 9 for constructing a fireproof power house, installing gas engines, air compressors, reservoirs, piping, et.c, and drilling a well at dams Nos. 8 and 11, Ohio river. Capt. F. W. Alstaetter, corps engrs.

Warren, O.—(Special)—Bert C. Smith, cy. engr., advises us that council, on Feb. 4, directed the director of the bd. of pub. service to ask for bids on a 16-yr. contract for municipal street lighting. Tungsten and arc systems are specified.

Grand Forks, N. D.—Bids are asked until Mar. 7 for furnishing and erecting mechanical and electrical equipment for the electric light plant. W. H. Alexander, cy. audt.

Defiance, O.—(Special)—John A. Foust, prest. cy. coun., says that city is considering the employment of a water and light expert engineer to examine the conditions here and advise as to the best interest of the city as well as to furnishing it with water and light.

Ashford, Ala.—(Special).—J. W. McIntyre, mayor, advises us that the installation of water works and light plant is desired in that own. Population 600.

Barnesville, O.—Bids are asked until Mar. 17 for lighting with electric light the streets, avenues, alleys, public grounds, public places and municipal buildings for a term of ten years. F. Waldo Hilles, vil. clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Atlanta, Ga.—Voted to issue $50,000 for crematories.

Salem, Ore.—The construction of a garbage crematory is contemplated.

Wenatchee, Wash.—A site has been secured for a garbage crematory.

South Bend, Ind.—The improvement of the city crematory is contemplated.

Topeka, Kas.—This city contemplates the construction of a garbage crematory. C. B. Burge, cy. clk.

San Francisco, Call.—Plans and specifications have been prepared for constructing 3 garbage crematories in the office of the city engineer, under the direction of Rudolph Hering, of New York City.

New York City—Contracts for the removal of snow in Manhattan, Brooklyn and Bronx boroughs have been awarded as follows: Manhattan, William Bradley, 1 Madison ave., at 75 cts per cu. yd.; Brooklyn, Newman & Holmes, at 54 cts. per cu. yd.; The Bronx, P. J. Kane & Co., 735 East 150th st., at 45 cts. per cu. yd.

PARKS.

Bay City, Tex.—D. P. Moore has donated a tract of six acres of land adjoining the city limits, to the city, to be used for a public park.

Newark, N. J.—A petition has been submitted to the board of trustees asking that the question of purchasing and improving land for use as a public park be voted on.

South Omaha, Neb.—The bd. of park commissioners adopted a resolution, Feb. 9, recommending that the city council issue $15,000 bonds to be used for permanent improvement of the parks.

Colorado Springs, Colo.—This city contemplates the purchase of a canon for use as a public park. An option has been secured on South Cheyenne canon, the tract including 322.35 acres and the purchase price being $317,500.

FIRE APPARATUS.

Charleston, S. C.—The purchase of a new motor fire engine is contemplated.

Olympia, Wash.—Bids are asked until Mar. 2 for a combination automobile chemical and hose truck. Cy. clk.

Tacoma, Wash.—A contract has been awarded to the Seagrove Co. for an auto attachment for hook and ladder truck No. 1, for $5,725.

Rock Island, Ill.—This city has purchased a combination automobile police patrol and ambulance from the Pope Mfg. Co., of Hartford, Conn., for $4,000.

Rochester, N. Y.—Contracts for fire apparatus were awarded, Feb. 9, as follows: 65-ft. aerial hook and ladder truck, Combination Ladder Co., of New York and Providence, R. I., $4,810; 2nd size steam engine, American La France Fire Engine Co., of Elmira, $5,800.

MUNICIPAL ENGINEERING

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TOWN SCAVENGING AND REFUSE DISPOSAL.

Disposal of House Refuse.

By Hugh S. Watson, A. M. I. C. E., London, Eng.

THE disposal of house refuse is usually effected in one or other of the following manners:

1. Filling low lying land with crude refuse, such land being temporarily designated "a tip" or "shoot."
2. Discharging crude refuse into the sea.
3. Separating the crude refuse by hand or machinery, and using the constituents in such trade as can profitably employ them.
4. Pulverizing the crude refuse by machinery, and using the product for manure, or in the manufacture of fuel by an admixture of tar.
5. Burning at a refuse destructor.

1. Filling Low Lying Land With Crude Refuse.—This method has been adopted by many of the metropolitan boroughs. The refuse is usually removed by contract, the authorities having to pay the contractors to remove it. The prices paid vary in the different districts, and are governed by the facilities for getting it away. The majority of the refuse removed from London is being taken by barges and deposited on the marshes at the mouth of the Thames, Swale and Medway, where there are many brickfields. The material is sometimes roughly screened before being sent away, in ordr to recover tins and iron fragments, which have a definite market value, and it is usually sorted a second time by the contractors' workmen to recover any remaining articles which are of value.

The preliminary sorting is sometimes done on platforms before the material is put into the barges, but it is more generally done in the barges themselves, as by this means less handling is incurred, since the carts can tip their contents direct into the barges.

When the barges arrive at their destination the refuse is unloaded and roughly sorted. The rough core, which consists mainly of old iron baths, tins, brickbats, etc., is usually buried in the bottoms of pits from which brick earth has been taken out. The remainder of the refuse is left in a heap, the heat in which, in the course of a few months, reduces paper and vegetable matter to such an extent that it is hardly traceable. During the winter months, when the manufacture of bricks is stopped, men turn into the heap, and sift it with a rotary sieve, the larger cinders and small coal recovered being used as fuel in burning the bricks, while the ashes are mixed with the clay used for making the bricks. Formerly there was a good demand in London for house refuse for these purposes, but latterly, owing to the depression in the brick trade, the demand has considerably decreased. This method of disposal is certainly one of the cheapest that can be adopted, as all that is required is a small wharf, and the responsibility of the authorities ceases as soon as the refuse has been delivered to the barges. There are several disadvantages, however, as in many cases the barges can only leave at high water, and sufficient material must therefore be delivered to load the barges by the time of high water, so as to make room for an empty barge to come alongside. Then, again, some provision must always be made for disposing of the refuse during times of fog, when the barges will not be able to get away.

2. Discharging Crude Refuse Into the Sea.—This system is adopted in many seaside towns, such as Liverpool, Dover, Newcastle-on-Tyne and Dublin. The refuse must be carted well out to sea and deposited under

such conditions that it may be quite impossible for it to cause any nuisance.

The refuse of Dover is taken about three miles out into the English Channel and there deposited. The barges in which it is removed hold about 70 tons each, and the cost of disposing of each barge load is £3 10s ($17.50), 1s (25 cents) per ton.

In Liverpool only a very small proportion of the refuse is disposed of by this means. In the year 1905, out of a total of 339,914 tons of refuse collected, only 42,284 tons were dealt with in this manner.

In Newcastle-on-Tyne, in the year 1906, 56,000 tons were barged to sea, out of a total of 154,653 tons of refuse collected.

Dublin formerly disposed of about one-third of the total amount of refuse collected each year by conveying it out to sea, but the greater portion is now being dealt with in destructors, owing to the fact that the Port Board called for the removal of the refuse barge from its berth at a central position in the city to a point three miles out, thereby greatly increasing the cost of cartage.

3. Separating the Crude Refuse by Hand or Machinery and Utilization of the Constituents.—This method of disposal has been attempted by several of the metropolitan boroughs in London, but has generally not been as satisfactory as was anticipated. Until recently the refuse collected in the borough of Paddington was disposed of by this means. The material was first tipped on to a grating across which it was dragged, and through which the smaller particles dropped into a receiver. The material was separated into two sizes by being passed through two sieves, the coarser material being termed "breeze," while the finer was known as "ashes." The breeze was hand-picked by women, so as to extract materials such as metals, bones, and glass, etc., the remainder consisting mainly of cinders. The ashes and breeze were disposed of to brickmakers. The refuse retained on the grating was hand sorted by men, and such articles as rags, bones, iron, lead, glass, boots, cardboard, tins, etc., were recovered, the residue being removed by a contractor, at the expense of the Council.

Th process has now been entirely discontinued, and the whole of the refuse of the borough is being barged away without any preliminary sorting.

The refuse collected in the borough of Bethnal Green is, at the present time, being disposed of in a somewhat similar manner. All the refuse brought to the works by the collecting carts is tipped on to a large grating, two-inch mesh, placed over a hopper having a small sump at the bottom. The material is raked over and any matter that will not pass through the grating is removed and burned in a furnace. The material which passes through the grating is raised from the hopper sump by an endless chain bucket conveyor. This delivers the material into a revolving screen having three different sizes of mesh, and open at the end, so that all matter which is too large to pass through any of the meshes is caught in a wagon which is placed at the open end of the screen. The whole of the matter which falls from the revolving screen is barged to various brickfields, where the fine stuff is mixed with clay and used for brickmaking, and the two larger sizes of material are used for burning the clay. The material fetches from 30s ($7.50) to £3 ($15) per barge load of 80 tons. The refuse burned in the furnace generates sufficient heat to provide its own forced draught, by means of a steam jet, which is supplied from a Babcock & Wilcox boiler. The steam pressure generated in the boiler varies from 60 to 70 pounds per square inch, and sufficient steam is generated to work a 12 horse-power Tangye horizontal engine, which drives the bucket conveyor and the revolving screen. About 100 tons of refuse are dealt with per day, of which one-third is burned in the furnace and two-thirds is passed through the revolving screen.

The refuse from the borough of Hampstead is disposed of in destructors, but the whole of the refuse collected is first sorted by a contractor, who employs his own men to do the work, and pays the Council the sum of £60 ($300) per annum for the privilege of being allowed to sort the material. The contractor employs five men to do the work, and apparently is able to make a profit from the materials after paying their wages and the sum due to the Council. The materials separated are glass bottles, broken glass, clean paper, rags, bones, boots and shoes, tins and scrap iron. Generally speaking, the system of disposal by hand separation and utilization cannot be said to be a sanitary one, although little objection can be taken on sanitary grounds to the system as carried out at Bethnal Green.

4. Disposal by Pulverization.—This process is an entirely novel one, and

CONCRETE AND BRICK BRIDGE OVER PENITENCIA CREEK ON ALUM ROCK PARK ROAD.

First concrete bridge built in Santa Clara County, Cal.

Built October, 1891. Cost, $1,000. Span, 36 feet. Roadway, 26 feet. J. G. McMillan, Engineer.

is still more or less in the experimental stage, at all events in this country, though the refuse from about one-quarter of the area of Paris is being dealt with on this system at an installation which has been erected at Vitry. The only refuse that is being disposed of by this means in England is a portion of the refuse of the metropolitan borough of Southwark. The machine employed is called a "lightning dust crusher," and consists of a comparatively small steel box containing four or six hammers, each weighing about 50 pounds, composed of special alloy steel. The axle on which these hammers hang is rotated by machinery at the rate of 800 or 1,000 revolutions a minute. The refuse is fed by shovels into the machine at the rate of four tons an hour, and comes out completely pulverized. The powder is sold as manure at the rate of 2s 2d (50 cents) per ton, which, after the working expenses and the cost of carriage have been takn into account, shows a loss of 7d (14 cents) per ton for disposal. The power required for driving the machine is between 18 and 22 horse-power.

The process adopted at Vitry is somewhat different. A preliminary screening is done to sort out large articles, such as tins, paper, bottles, wire, crockery, etc., which are collected and sold. The rest of the material is passed into the pulverizers, on coming from which it is delivered onto a screen having a mesh of three-fourths inch. The material which passes through the screen falls into a hopper, from which it is discharged into railway trucks drawn up underneath, and is used for manure. The material which is too large to pass through the screen is discharged into a hopper, from which it is raised and discharged by means of a shoot over a furnace. At the bottom of the shoot is fixed an Archimedean screw, which draws the matter forward and distributes it over the furnace, in which it is rapidly burned, and the steam generated from its combustion is utilized to provide the power required for driving the plant.

5. Burning at a Refuse Destructor.—This method has of recent years been more generally adopted, mainly on sanitary grounds, in those districts where an absence of any other more economical system of disposal has forced the authorities to adopt this system, as no destructor has yet been made to pay its own way by the utilization of the residuals. In some instances a proportion of the cost of disposal has been recovered, either by the generation of heat which has been transformed into energy, or else by the manufacture of marketable products from the residuals. There are a number of types of destructors upon the market, amongst which may be mentioned those of Messrs. Manlove, Alliott & Co., Horsfall & Co., Goddard, Massey & Warner, Hughes & Sterling, and Heenan & Froude.

The general principles of destructor design may be briefly described as follows: A large grate area is provided on which the refuse to be burnt is deposited. The material is sometimes fed onto the grating by means of what is known as a "top feed," that is to say, a shaft is constructed rising vertically from the back of the furnace to a platform above, so that the refuse may be tipped either onto the platform and raked from there into the furnace, or else may be tipped directly from the carts into the furnace. This is the more general method. The alternative methods are to shovel the material onto the gratings through openings provided either in front or at the back of the furnaces, which systems are known respectively as the "front" and "back" feeds. A forced draught is required both to assist in burning the material and also to aid in producing a high temperature, in order that any noxious fumes may be thoroughly cremated before they are permitted to escape into the open air. The forced draught is sometimes supplied by means of steam jets, and in other cases by means of fans. The draught is in some types admitted immediately beneath the gratings at the front of the furnace, and in others through openings provided in the side walls. As an aid to inducing a draught and also in order to disseminate the gases created in such a manner that they may cause as little nuisance as possible, chimneys are generally constructed in connection with the destructors, and in most cases a dust catcher is provided between the destructor and the chimney to arrest any fine particles of matter which may not have been entirely burnt.

The aim of every design of destructor is to raise as much steam as possible, while securing complete combustion. In many cases, also, the heat of the waste gas is utilized, either to heat the air for the forced draught, or the feed water for boilers, or else to superheat the steam generated by them in cases where this is used for purposes other than merely producing the forced draught. By heating the

CONCRETE BRIDGE OVER STEVENS CREEK ON MOUNTAIN VIEW DEPOT ROAD, SANTA CLARA COUNTY, CAL.

Cost, $1,473. Span, 36 feet. Roadway, 20 feet. J. G. McMillan, Engineer.

air supply, the temperature is kept more constant, and therefore the wear and tear of the cells will be less. It also makes it easier to fire up after clinkering. If the feed water is heated before being supplied to the boilers, their working will be more regular, and therefore the wear and tear will be less, while a larger quantity of steam will also be developed. The advantage of superheating the steam lies in the fact that the loss due to condensation in the pipes and cylinders of the engine which it may be used to drive will be considerably diminshed. A further advantage gained by the utilizing of the heat contained in the waste gases is that their temperature being reduced before they are transmitted to the chimney, the life of the latter will be prolonged.

Choice of Site for a Refuse Destructor.—In selecting the site for a refuse destructor several considerations have to be borne in mind. From the point of view of lessening the amount of carting to be done in collecting the house refuse, it should be placed in a central position. In order to make it pay its way as far as possible it should be placed in such a position that the steam raised may be used, and that the residuals produced may be utilized to the best advantage. It will generally be very difficult to find a site which will fulfill both these conditions without being unduly expensive, as the central portions of most towns are usually those in which the site values are the highest. The disappointing results which have attended the working of most of the destructors of the metropolitan boroughs of London may be directly attributed to the difficulty of finding sites which will comply with the required conditions. Excessively high rents and the high prices of labor cause heavy working expenses, while there is considerable difficulty in disposing of the clinker produced, owing to the cost of carriage and competition from destructors situated in outlying districts, since there is no great demand for the material in London itself. Indeed, it is quite an open question whether it would not be found more economical to remove the whole of the London refuse to destructors situated in the country, where land and labor would be much cheaper and where a real demand exists for the refuse for manure and for the clinker for building purposes.

At many destructors the steam generated is used in connection with the generation of electricity, but this cannot be done in many instances in London, owing to the fact that the electricity undertakings are in the hands of private companies. The best uses to which steam generated by destructors can be put are the pumping of a town's water or sewage or for electric lighting or traction, as for these purposes the power will be required almost continuously throughout the whole twenty-four hours. Other uses to which it has been put are the heating of buildings, driving of laundry machinery and machinery in connection with slab and brickmaking plants.

SPECIFICATIONS FOR SHEET ASPHALT PAVEMENT.*

SUB-DRAINAGE.—When the soil is of such a character that it retains an excessive amount of moisture, such as clays subject to swelling or heaving under the action of frost, or sands similar to quick sand that do not afford a ready natural drainage, subdrains should be provided. These may be of two general kinds: (1) Tile drains of open porous material, or vitrified tile laid with open joints; (2) trenches filled with broken stone, gravel, cinders or other similar material.

In some cases it may be sufficient to construct a sub-drain on each side of the roadway at or near the lines of the gutters, but when the soil is of a very wet nature, it may be advisable to lay additional lines of drains which may be in or near the middle of the roadway. This system of drains may be varied by diagonal lines of drains running from near the crown of the roadway to the gutters. In all cases the drains should have connections with the existing sewers, catchbasins or inlets.

Foundations.—After all necessary grading has been done to bring the surface to sub-grade, the street shall be thoroughly rolled with a steam roller weighing not less than ten tons. If settlement occur, the depression

*Report of Asphalt Committee of the Organization for Standardizing Paving Specifications.

CONCRETE BRIDGE OVER COYOTE CREEK ON BERRYESSA ROAD, SANTA CLARA COUNTY, CAL.

Cost, $13,332. Spans, two—one 68 feet, one 40 feet. Roadway, 68 feet. J. G. McMillan, Engineer.

shall be filled and then rolled until the surface is solid and uniform. All filling shall be free from animal or vegetable matter, and of a character approved by the engineer. Should the foundation be of sand, which would be impracticable to roll, the entire roadway from curb to curb shall be thoroughly puddled by flooding with water one or more times if found to be necessary. The contractor shall furnish all water and hose for puddling and all the labor necessary to properly perform the work.

Refined Asphalt.—The refined asphalts to be used for paving mixtures herein required shall be derived in the following manner:

1. By heating, if requiring refinement, crude, natural, solid asphalt, to a temperature of not over 400 degrees F. until all the water has been driven off. Crude, natural, solid asphalt shall be construed to mean any natural mineral bitumen, either pure or mixed with foreign matter, from which, through natural causes in the process of time the light oils have been driven off until it has a consistency harder than 100 penetration at 77 degrees F. At least 98½ per cent. of the contained bitumen in the refined asphalt which is soluble in cold carbon bisulphide shall be soluble in cold carbon tetrachloride. Such asphalt must melt readily upon the application of heat. In no case shall it be prepared at the refinery with any product not hereinafter provided for.

2. By the careful distillation of asphaltic petroleum until the resulting residue has a consistency not harder than 40 penetration at 77 degrees F.

(a) The solid residue so obtained shall be soluble in carbon tetrachloride to the extent of 98½ per cent.

(b) Its bitumen shall yield upon ignition not more than 15 per cent. of fixed carbon.

(c) When 20 grams of the material are heated for five hours at a temperature of 325 degrees F. in a tin box 2½ ins. in diameter, after the manner officially prescribed, it shall not lose over 5 per cent. by weight, nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

(d) A briquette of the solid residue having a cross-section of one square centimeter shall have a ductility of not less than 30 centimeters at 77 degrees F.

Note: Combinations of asphaltic and semi-asphaltic residues having the ductility and other characteristics above named are admitted under Section 2.

3. By combining at the paving plant in uniform and fixed proportions which shall be satisfactory to (proper city official) solid, natural asphalt and solid asphaltic residue as hereinbefore described. The refined natural asphalt shall be derived from the crude natural asphalt of the quality and in the manner specified before, except that the crude natural asphalt may have added to it, if desired, at the refinery, as a partial fluxing, an amount of asphaltic or semi-asphaltic flux of the character and within the limit specified elsewhere herein, such fluxing to be conducted under the supervision of (proper city official) when desired. In the use of these mixtures of refined asphalts or asphaltic cements only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine flux without the further addition of any other material it will produce an asphaltic cement complying with the requirements hereinafter set forth under that head. In such cases any of the fluxes elsewhere herein specified may be used.

The preparation and refining of all asphalts admitted under these specifications shall be subject to such inspection at the paving plants and refineries as the (proper city official) may direct.

Flux.—The fluxing may be a paraffine, a semi-asphaltic or an asphaltic residue which shall be tested with and found suitable to the asphalt to be used. It shall be free from water or other impurities.

The residuums must have a penetration greater than 3½ centimeters, with a No. 2 needle at 77 degrees F. under 50 grams weight for 1 sec.

A natural Maltha may be used if it passes the heat and flash tests specified under "a" (below), and all fluxes must furthermore remain soft after heating for five hours at 400 degrees F.

All residuums shall be soluble in cold carbon tetra-chloride to the extent of 99 per cent.

(a) The paraffine residuum shall have a specific gravity of 0.92 to 0.94 at 77 degrees F. It shall not flash below 350 degrees F. when tested in the New York State closed oil tester, and shall not volatilize more than 5 per cent. of material when heated five hours at 325 degrees F. in a tin box 2½ ins. in diameter as officially prescribed. The residue after heating shall flow at 77 degrees F. and shall

STONE AND CONCRETE BRIDGE OVER LLAGAS CREEK ON LEAVESLY ROAD, SANTA CLARA COUNTY, CAL.

Cost, $3,703. Span, 48 feet. J. G. McMillan, Engineer.

be homogeneous, and shall show no coarse crystals.

(b) Semi-asphaltic residuum shall have the same general characteristics as paraffine residuum, except that it shall have a specific gravity of .94 to .98 at 77 degrees F.

(c) Asphaltic residuum shall have the same general characteristic as paraffine residuum, except that the specific gravity shall not be less than .98 nor more than 1.04 at 77 degrees F. The asphaltic residuum after evaporation at 500° degrees F. to a solid penetration shall have a ductility of not less than 30 cm.

Asphaltic Cement.—The asphaltic cement prepared from materials above designated shall be made up from the refined asphalt or asphalts, and the flux, where flux must be used, in such proportions as to produce an asphaltic cement of a suitable degree of penetration. The proportion of the refined asphalts comprising the cement shall in no case be less than 40 per cent. by weight.

When weight of flux in the asphaltic cement prepared from solid natural asphalts exceeds 25 per cent. thereof, asphaltic or semi-asphaltic flux shall be used. Semi-asphaltic flux in such case must have a gravity of not less than .95 at 77 degrees F.

Refined asphalts and flux comprising the asphaltic cement shall, when required, be weighed separately in the presence of the authorized inspectors or agents of (proper city officials).

Refined asphalt and flux used in preparing the cement shall be heated together in a kettle at temperatures ranging from 250 degrees to not over 375 degrees F., and be thoroughly agitated when hot by air, steam or mechanical appliances, until the resulting cement has become thoroughly mixed into a homogeneous mass. The agitation must be continued during the entire period of preparing the mixtures. Cement shall always be of uniform consistency, and if any portion should settle in the kettles between intervals of using the same, it must be thoroughly agitated before being drawn for use.

The asphaltic cement shall have a penetration of from 30 to 100, which shall be varied within these limits to adapt it to the particular asphalt used in the paving mixture and to the traffic and other conditions of the street.

(a) When 20 grams of the asphaltic cement of the penetration to be used in the paving mixture shall be heated for five hours at a temperature of 325 degrees F., in an oven as officially specified, there must not be volatilized more than 5 per cent. of the bitumen present, nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

(b) The bitumen of the asphaltic cement shall give upon ignition not more than 15 per cent. of fixed carbon.

(c) A briquette of the pure bitumen of the asphaltic cement of the penetration to be used in the paving mixture, having a cross-section of 1 sq. cm., shall elongate to the extent of not less than 10 cm. nor more than 100 cms. at 77 degrees F.

Sand.—The sand shall be hard-grained and moderately sharp. It shall be free from loam or any other foreign material, and shall be so graded as to produce, in the finished surface mixture, the mesh requirements elsewhere herein specified. It shall contain not to exceed 6 per cent. of sand that will pass a No. 200-mesh sieve.

Binder Stone.—Stone or gravel to be used for asphaltic concrete binder shall be hard and durable, free from all foreign substances, and of varying sizes, from 1 in. down.

Preparation of Asphaltic Concrete Binder. — Asphaltic concrete binder shall be made as follows: The binder stone and sand, as above specified, shall be heated to from 200 to 325 degrees F. in suitable appliances. Stone and sand shall be measured off separately and then be mixed with sufficient asphaltic cement, prepared as heretofore specified, in such proportions that the resulting aggregate will contain by weight material passing a No. 10 mesh screen, between 30 and 40 percent. and bitumen in quantity from 5 to 8 per cent. of the entire mixture. Concrete thus prepared shall be a compact mass containing a minimum of voids. If the permission of (proper city officials) be available, old asphaltic surface paving mixtures may be used in combination with the binder stone, such mixtures having been previously crushed or disintegrated and augmented with at least 1 per cent. of fresh asphaltic cement, so that when combined the resulting concrete shall form an equally compact mass and correspond as to aggregate passing a No. 10 mesh screen and in contained percentages of bitumen with the requirements for the mixture previously specified.

Note: Inasmuch as the percentage of bitumen in the binder will depend upon the grading of the aggregate, the proportions of the materials used in the above may be varied by (author-

CONCRETE BRIDGE OVER GUADALYPE CREEK, SANTA CLARA COUNTY, CAL.
J. G. McMillan, Engineer.

ized city official), but only within the limits designated.

Laying Asphaltic Concrete Binder.—The asphaltic concrete binder shall be brought to the work in wagons, covered with canvas or other suitable material, and upon reaching the street shall have a temperature of 200 to 325 degrees F. It shall be placed upon the street and raked to a uniform surface to such depth that, after being rolled and thoroughly compacted, it shall have a thickness of —— ins. The surface, after compression, shall show at no place an excess of asphaltic cement, and any spot covering an area of 1 sq. ft. or more showing an excess of asphaltic cement shall be cut out and replaced with other material. Smaller spots may be dried by the use of stone dust and smoothers. Any asphaltic concrete binder broken up during the process of laying must be removed and replaced with new material. Asphaltic concrete binder shall be followed and covered with wearing surface as soon as is practicable in order to effect the most thorough bond between the binder and the wearing course.

Asphaltic Surface Mixture or Wearing Course.—The committee, in presenting two kinds of mixtures for wearing surface, one having as filler Portland cement and one with a stone dust filler, considers that the adoption or application of either would be a matter of local conditions, and accordingly should be left to the discretion of the engineer in charge of such paving construction.

The surface mixture shall consist of asphaltic cement, Portland cement (stone dust) and sand, proportioned by weight so that the resulting mixture will contain average proportions of the whole mixture as follows:

Mixture A.	Per Cent.
Bitumen soluble in cold carbon bisulphide	11.0 to 13.5
Portland cement passing a No. 200 sieve	10.0 to 15.0
Sand passing a No. 80 sieve	18.0 to 36.0
Sand passing a No. 4 sieve.	up to 10.0

Mixture B.	Per Cent.
Bitumen soluble in cold carbon bisulphide	10.5 to 13.5
Stone dust passing a No. 200 sieve	10.0 to 15.0
Sand passing a No. 80 sieve	18.0 to 36.0
Sand passing a No. 40 sieve	20.0 to 50.0
Sand passing a No. 10 sieve.	8.0 to 20.0
Sand passing a No. 4 sieve.	up to 10.0

The item designated as "Portland cement (stone dust) passing a No. 200 sieve" within the limits named herein, includes in addition to the Portland cement (stone dust) find sand passing a No. 200 sieve not exceeding 4½ per cent. of the total mixture, and such 200-mesh mineral dust naturally self-contained in the refined asphalt.

Sand and asphaltic cement shall be heated separately to about 300 degrees F. The maximum temperature of the sand at the mixers shall in no case be in excess of 375 degrees F., and the maximum temperature of the asphaltic cement shall not exceed 325 degrees F. at the discharge pipe. The Portland cement (stone dust) shall be mixed with the hot sand in the required proportions, and then these shall be mixed for at least 1 minute with the asphaltic cement at the required temperature, and in the proper proportions in a suitable apparatus, so as to effect a thoroughly homogeneous mixture.

The proportion of asphaltic cement shall at all times be determined by actual weighing with scales attached to the asphaltic cement bucket. The Portland cement (stone dust) and sand must also be weighed, unless a method of gauging approved by the (authorized city official) shall be used. The contractor shall furnish every facility for the verification of all scales or measures. The sand gradings and bitumen may be varied within the limits designated, in the discretion of (proper city official).

Laying the Wearing Surface.—The asphalt wearing surface shall be hauled to the work in wagons provided with a canvas or other suitable cover. It shall leave the plant at a temperature between 250 and 325 degrees F., as suitable for the asphalt used. Upon arrival at the street it shall be dumped at such distance from the work that all of the mixture must be turned and distributed to the place where it is to be raked. It shall be spread, while hot, to such depth upon the asphaltic concrete binder, which must be thoroughly dry, free from leaves or other foreign matter, that after receiving its ultimate comprission by rolling it shall have a thickness of —— ins. The initial compression may be effected by means of a small roller, after which a small amount of mineral dust shall be swept over the surface. The final compression shall be effected by a 10-ton roller or the equivalent of not less than 250 lbs. per running inch width. Rolling must be steadily kept up and continued until all roller marks shall disappear and the surface shall give indication of no further compressibility.

CORCRETE BRIDGE OVER LOS GATOS CREEK ON CAMPBELL AVENUE, SANTA CLARA COUNTY, CAL.

Cost, $4,077. Span, 50 feet. Roadway, 30 feet. J. G. McMillan, Engineer.

Note: All tests herein provided must be conducted according to official methods on file in the office of (proper official).

All penetrations indicated herein, unless otherwise specified, refer to the depth of penetration in hundredths of centimeters of a No. 2 needle weighted with 100 grams at 77 degrees F. acting for 5 seconds.

SPECIFICATIONS FOR BITUMINOUS CONCRETE PAVEMENT.*

(In the specifications for bituminous concrete the committee does not assume to pass on the validity of patents that may have been issued for certain paving mixtures and methods, and the various municipalities that may adopt these specifications are advised to determine their own policies as to the recognition of these patents.)

Foundation.—The foundation upon which the pavement is laid may be either concrete or macadam.

Concrete Foundation.—This may be laid according to the standard specifications for concrete foundation, the surface being made rough and grainy so the paving material may get a proper bond or grip on the concrete.

New Macadam Foundation.—If the pavement is to be laid on a new macadam foundation, the macadam shall be built according to the standard specifications, except that the upper ½ in. shall not be completely filled and bonded, the intention being (as with the concrete foundation) to produce a somewhat rough, grainy surface into which some the paving mixture will be forced by the roller. For heavy traffic 8 ins. of well-compacted macadam may be considered equal to 6 ins. of concrete; and for light or ordinary traffic 6 ins. of macadam equal to 4 or 5 ins. of concrete.

Old Macadam Foundation.—If the pavement is to be laid on an old macadam base, the surface shall be thoroughly swept and cleaned of all fine material that may be either caked upon the surface of the stone or lying loose as dust, thereby exposing the clean stone in the surface for the reception of the paving material. If the old macadam is not in suitable condition or proper grade after cleaning, it shall be spiked up and redressed to the proper crown and grade, the coarse stone being left at the top, or new stone added when, in the opinion of the engineer, it is needed to give the desired grainy surface or thickness of foundation.

It shall then be thoroughly rolled with the use of as little water as possible, so the macadam does not finish smooth.

When it is not practicable to secure a foundation, either macadam or concrete, with sufficient grain in the surface to give the desired bond or key between the foundation and the paving material, the adhesion between the two may be increased by sprinkling the foundation with the bituminous cement before the paving mixture is spread, using not exceeding ¼ gal. per sq. yd.

Old Brick or Granite Foundation.—An old brick or granite block pavement, if in the opinion of the engineer it is well supported and stable, may be used as a base by thoroughly cleaning the old pavement and sprinkling its surface with the bituminous cement.

Wearing surface.—On the foundation as specified shall be laid the bituminous concrete wearing surface, which shall be composed of carefully selected, sound, hard, crushed stone and sand mixed with bituminous cement and laid as hereinafter specified. This wearing surface shall have a thickness of — ins. after thorough compression with a 5-ton tandem roller.

Mineral Aggregate.—The mineral aggregate shall consists of broken stone or broken stone and sand of a fairly uniform grading from the largest to the smallest particles in such proportions as to give the mixture a maximum degree of density and low percentage of voids. The maximum size of stone used may range from that passing a screen having circular openings from ¾ in. to 1¼ ins. diameter. Crusher run of stone between 1 in. and screenings passing ¼ in. may be used if found to be fairly evenly graded. Coarser stone when used shall

*Report of committee of the Organization for Standardizing of Pavement Specifications.

be graded and remixed in proper proportion. (The screenings passing the ¼ in. mesh screen may be used when the bitumen is refined coal tar or an asphalt not having a low ductility.) Coarse and fine sand having proper grading shall be added in such proportions as necessary to secure the dense aggregate specified above. Stone dust or hydraulic cement may be added as needed when the character of the bitumen used requires it.

Bituminous Cement.—The bituminous cement may be either refined coal tar or asphaltic cement.

Coal Tar.—The coal tar must be the residue of the distillation of coal tar only, and be specially refined for the purpose. No admixture of hard pitch with the lighter oils of coal tar will be permitted. The cement shall conform to such physical and chemical tests necessary to satisfy the (local officials) as to its suitability.

(The committee does not find available sufficient data enabling the preparation of more detailed specifications at this time. It recommends careful experiments and collection of data for future consideration.)

Asphaltic Cement.—The asphaltic cement may be prepared (1) from refined natural asphalt; (2) from the residue obtained in the oxidation or distillation of asphaltic or semi-asphaltic petroleum; (3) from any uniform combination of the preceding materials together with a suitable flux, if flux be necessary, such combination being subject to the approval of the engineer.

Each bidder must state the nature and origin of the bitumen to be used by him, and further shall submit samples of the bitumen with his proposal. The asphaltic cement shall pass the requirements designated below.

(1) It shall have a penetration of 30 to 100 at 77 degrees F., which shall be suitable to the nature of the material used and to the traffic and other conditions of the street.

(2) When 20 grams of the cement are maintained at a temperature of 325 degrees F. for five hours in a tin box 2½ ins. diameter, there must not be volatilization of more than 3 per cent. by weight of the bitumen present, nor shall the original penetration be reduced thereby over one-half.

(3) The bitumen of the asphaltic cement shall give upon ignition not more than 15 per cent. of fixed carbon.

(4) Of the bitumen of the asphaltic cement which is soluble in carbon disulphide, 98½ per cent. shall be soluble in carbon tetra-chloride.

(5) At 32 degrees F. the bitumen of the cement shall have a penetration of not less than 10 when tested one minute with the needle weighted to 200 grams, and at 115 degrees F. when weighted to 50 grams for five seconds, shall have a penetration of not more than 280.

(6) The cement shall not flash at a less temperature than 350 degrees F., New York State closed oil tester.

Method of Mixing.—The aggregate shall be thoroughly dried in properly designed driers before mixing with the bitumen. The driers shall be of the revolving type, thoroughly agitating and turning the materials during the process of drying. When the aggregate is thoroughly dried and heated to a temperature of from 200 to 350 degrees F., depending on the bituminous cement used, it shall be immediately, before cooling or exposing to moisture, mixed with the hot bituminous cement as hereinafter specified.

The bituminous cement shall be melted in a tank arranged so the heat can be properly and easily controlled and regulated. When melted and raised to a temperature of from 200 to 350 degrees F., depending on the bituminous cement used, it shall be combined in proper proportions with the hot aggregate and immediately mixed in a properly designed mixer with revolving blades until a thorough and intimate mixture of the ingredients has been accomplished, and the particles composing the aggregate evenly and thoroughly coated with the bituminous cement. The mixer shall not be exposed directly to the action of the fire.

Laying.—While still hot from the mixer, the paving mixture shall be spread evenly on the foundation with hot iron rakes or shovels or both, so that when compressed with the roller it shall have the thickness specified above, with the surface even and true to grade. Along the curb and around manholes, catchbasins and other obstructions in the street where the roller cannot reach, the compression shall be secured by the use of hot iron tampers. The tamping shall be done as quickly as possible after the material is spread, while still hot and pliable. When the paving mixture is hauled on the street in dump wagons it shall be kept covered with canvas to retain heat, dumped on platforms and shoveled into place and raked to secure the proper grade. As soon as the temperature will permit, the paving mixture shall be rolled with a tandem steam roller weighing at least five tons, and the rolling continued,

working lengthwise and diagonally of the street. Rolling must be steadily kept up and continue until all roller marks shall disappear, and the surface gives indication of no further compressibility.

The paving shall be done continuously, so the number of joints between the hot and cold material shall be reduced to the minimum. When it is not practicable to lay it continuously and a joint is unavoidable, the edge of the cold material shall be trimmed down to a rough feather edge, and the surface, where the joint is to be made, painted over with bituminous cement, the hot material raked over the feathered edge and thoroughly rolled. Instead of trimming the cold material, joint strips may be used, consisting of strips of canvas about 18 ins. wide with three parallel lines of ¾ in. ropes sewed on the under side about 3 ins. apart. The joint strips shall be laid on the feather edge of the freshly raked material, with the upper rope at the line where the thickness begins to decrease, and the rolling completed on top of the canvas as for finished pavement. The faces of the curb and gutter, iron castings, etc., shall be painted with the bituminous cement before the paving mixture is laid.

Surface Finish.—As soon as possible after the rolling of the mixture is finished, and while the surface is still fresh and clean, and if possible while warm, a skin coat of bituminous cement of proper consistency to be flexible when cold shall be spread over the surface. It shall be spread on while at a temperature of from 200 to 300 degrees F., depending on the bituminous cement used, and evenly spread with rubber squeegees. Only a sufficient coat shall be spread to flush the surface voids without leaving an excess. Immediately over this a top dressing of torpedo sand, fine gravel or stone chips free from dust, which must be thoroughly dry and heated in cold weather, shall be spread and thoroughly rolled into the surface. A small surplus shall be left to be worn in or worn away by the traffic.

After the sand or stone chips have worn into the surface, the street shall be swept, all excess of surfacing material removed, and the street left clean.

SPECIFICATIONS FOR CONCRETE SIDEWALKS, CURBS AND GUTTERS AND PAVEMENTS.*

CEMENT.

THE cement shall meet the requirements of the standard specifications for Portland cement of the American Society for Testing Materials (adopted August 16, 1909), with Section 21 amended to read as follows:

	Strength lbs. per sq. in. Neat.
24 hours in moist air	175
7 days (1 in moist air, 6 in water)	500
28 days (1 in moist air, 27 in water)	600

Provided, however, if the cement fails to meet the requirements of the 24-hour test, it may, at the discretion of the engineer, be held for further tests before being rejected, with the mixture of 1 cement to 3 standard Ottawa sand, and in no case shall the increase in strength at 28 days be less than 20 per cent. over the strength shown at 7 days.

CONCRETE FOR PAVING FOUNDATIONS.

1. Cement.—(As specified above.)

2. Fine Aggregate.—The fine aggregate shall consist of any material of siliceous, granitic or igneous origin, free from mica in excess of 5 per cent. and other impurities, uniformly graded, the particles ranging in size from ¼ in. to that which will pass a No. 100 standard sieve.

3. Coarse Aggregate.—The coarse aggregate shall be sound gravel, broken stone or slag, having a specific gravity of not less than 2.6. It shall be free from all foreign matter, uniformly graded, and shall range in size from ¼ in. up, the largest particles not to exceed in any dimension half the thickness of the concrete in place.

4. Proportions.—In preparing the concrete, the cement and aggregate shall be measured separately, and then mixed in such proportions that the resulting concrete shall contain fine aggregate amounting to half of the volume of the coarse aggregate; and that

*Report of committee of the Organization for Standardizing Paving Specifications.

7 cu. ft. of concrete in place will contain 94 lbs. of cement.

5.—Mixing.—The ingredients shall be thoroughly mixed, sufficient water being added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed, and each particle of the fine aggregate is thoroughly coated with cement, and each particle of the coarse aggregate is thoroughly coated with mortar.

Where a mechanical concrete mixer is used, the materials must be proportioned dry, and then deposited in the mixer all at the same time. The mixer must produce a concrete of uniform consistency and color, with the stones thoroughly mixed with the water, sand and cement.

6. Consistency.—The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under light tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

7. Re-tempering. — Re-tempering, that is, re-mixing with additional water, mortar or concrete that has partially hardened, will not be permitted.

8. Placing Concrete.—The concrete shall be deposited in a layer on the sub-grade in such quantities that, after being thoroughly rammed in place, it will be of the required thickness, and the upper surface shall be true, uniform and parallel with the surface of the finished pavement.

In conveying the concrete from the place of mixing to the place of deposit, the operation must be conducted in such a manner that no mortar will be lost, and the concrete must be so handled that the foundation will be of uniform composition throughout, showing no excess nor lack of mortar in any place.

9. Protection.—When complete, the foundation shall be kept moist for four days, and it shall be protected from traffic until the concrete has thoroughly set before the wearing surface is put on.

CONCRETE PAVEMENT.

Because of lack of experience with this form of pavement, we hesitate to recommend the adoption of specifications. This subject should be given further study. There are two or more concrete pavements now in use, on which patents have been obtained. We consider it outside of the jurisdiction of the committee to pass upon the merits of these pavements. If any municipality should desire to lay any of these patented pavements, specifications should be obtained from the patentee, but the materials used in the work should conform to the requirements of the standard specifications.

We believe that there are conditions where traffic is light, and economy and cost are essential considerations, where a concrete pavement may be used to advantage. In such cases we recommend for your consideration the following specifications:

[These specifications for concrete pavement are identical with the foregoing specifications for concrete foundation, with exceptions as follows:

(A) The coarse aggregate is to be "sound broken stone, trap rock, or granite, having a specific gravity not less than 2.6," etc.

(B) The proportions to be such that 5 cu. ft. of concrete (instead of 7 cu. ft.) will contain 94 lbs. of cement.

There are also the following additional paragraphs:

9. Finishing.—The pavement shall be finished by thorough hand-tamping until the mortar flushes freely to the surface, then lightly tamped with a templet made of 2-in. plank shaped to conform to the curvature of the surface of the finished pavement and having a length of not less than half the width of the roadway to give a uniform surface, with the slight markings thus made transverse to the street.

10. Expansion Joints. — Expansion joints shall be placed at right angles to the curb line at intervals of 50 ft. These joints shall be not less than 1 in. wide, and shall be filled with creosoted soft wood timber with the grain vertical and extending full depth of the pavement.

11. Protection to Work.—During the first four days after placing, the pavement shall be kept moist, and it shall be protected against traffic until the concrete has thoroughly set. In no event shall the pavement be used within ten days after being laid.

CONCRETE SIDEWALK.

[These are identical with the specifications for concrete foundation, except for the paragraphs given herewith.]

Coarse Aggregate.—The coarse aggregate shall be sound gravel, broken stone or slag, having a specific gravity of not less than 2.6. It shall be free from all foreign matter, uniformly graded, and of sizes that will pass a 1-in. screen and be retained on a 1¼-in. screen.

Water.—The water used in mixing the concrete shall be clean, free from

oil, acid, strong alkalis or vegetable matter.

Base Proportions.—In preparing the concrete for the base, the cement and aggregate shall be measured separately, and thenmixed in such proportions that the resulting concrete shall contain fine aggregate amounting to half of the volume of the coarse aggregate; and that 5½ cu. ft. of concrete in place will contain 94 lbs. of cement.

Consistency.—The materials shall be mixed to produce a concrete of such consistency that the water will flush to the surface under heavy tamping.

Forms.—The forms shall be smooth, free from warp, of sufficient strength to resist springing out of shape, and of a depth to conform to the thickness of the proposed walk. All mortar and dirt shall be removed from forms that have been previously used.

The forms shall be well staked and set to the established lines, their upper edges conforming to the grade of the finished walk, which shall have sufficient fall from the lot line towards the curb line to provide for drainage, but shall not exceed ⅜ in. per ft.

The base shall be blocked out in sections, which shall not measure more than 6 ft. in any dimension.

The cross forms shall be of ¼in. metal, of a depth to correspond to the thickness of the proposed walk, and shall extend full width of the walk and be set at right angles to the side forms. They shall be left in place until the wearing surface is floated.

Wearing Surface.—The wearing surface shall be composed of 1 part Portland cement and 2 parts fine aggregate, mixed with sufficient water to produce a mortar of a consistency which can be easily spread into position with a straight edge. The mortar shall be mixed in a mortar box and spread on the base immediately after mixing. In no case shall the wearing surface be placed after the base has set.

After the wearing surface has been worked to an approximately true plane the slab marking shall be made directly over the joint in the base. Such marking shall be made with a tool which will cut entirely through and completely separate the surface of adjacent slabs.

Edges.—The slabs shall be rounded on all surface edges to a radius of about ½ in.

Troweling.—The surface shall be troweled smooth. The application of neat cement to the surface in order to hasten hardening is prohibited.

Protection.—When completed the walk shall be kept moist and protected from traffic and the elements for at least three days.

CONCRETE CURB AND GUTTER.

These specifications are practically identical with those for concrete walks, except as to the fine aggregate and the requirement that the work must be kept moist for four days and protected for at least ten days. The two exceptional paragraphs are as follows:

Fine Aggregate.—The fine aggregate shall consist of any material of siliceous, granitic or igneous origin, free from mica in excess of 5 per cent., and other impurities, and shall be graded sizes ranging from ⅛ in. down to that which will be retained on a No. 80 standard sieve for the top wearing surface; and from ¼ in. down to that which will pass a No. 100 standard sieve for the base.

Curb and Gutter Not Built in Place. —Where built at a point removed from the work, they shall be constructed in the same manner and of the same materials as above specified, and shall be allowed to harden for at least ten days before being transported to their position in the work. The length of any section shall be not less than 4 ft. nor more than 6 ft.

SPECIFICATIONS FOR CREOSOTED WOOD BLOCK PAVEMENT.*

YOUR committee that was appointed for the purpose of drafting standard specifications for creosoted wooden block pavement has had three separate sessions of one-half day each, at which all members of the committee were present except Mr. MacVicar, of Des Moines, who was called out of town. His place, however, was acceptably filled by Mr. J. K. Mitchell, of Detroit. The committee has called in consultation all of

*Report of committee of the Organization for Standardizing Paving Specifications.

the manufacturers of wood block pavement that it was possible to reach, four companies being represented before the committee, and another one informally with the chairman. The committee has discussed the question in every phase, and after giving careful consideration to the statements of all of the manufacturers, it has decided to recommend the following as the principles upon which specifications shall be drafted, the idea being that these principles would be sufficient to enable any manufacturer to make a block that would conform to the specifications and at the same time permit the local engineer to adapt same to conditions in his particular city. The conclusions which were reached are as follows:

TIMBER.

The wood to be treated shall consist of long leaf yellow pine, Norway pine, black gum and tamarack, only one kind of wood, however, to be used in any one contract.

Yellow pine blocks shall be cut from what is known as prime timber, namely, all timber must be sound, commercial long leaf yellow pine, well manufactured, full size, saw-butted, all square edge, and shall be free from the following defects: Unsound, loose and hollow knots, worm holes and knot holes, through shakes and round shakes that show on the surface. In yellow pine timber the annual rings shall average not less than six to the inch measured radially from the center of the heart.

Norway pine block, gum and tamarack blocks shall be cut from timber that is first class in every respect, and shall be of the same grade as that defined for the yellow pine.

SIZE OF BLOCKS.

The blocks shall be from five to ten inches long, but shall average eight inches; they shall be three and one-half (3½) and four (4) inches in depth, according to traffic; they shall be from three (3) to four (4) inches in width, but all blocks in one street or improvement shall be of uniform width, provided that blocks three (3) inches in depth can be used on residential streets and in alleys; provided further that in no case shall the width and depth of the blocks be the same.

A variation of 1-16 of an inch shall be allowed in the depth and ⅛ of an inch in the width of the blocks.

TREATMENT.

The blocks shall be treated with a preservative oil elsewhere described, so that the pine and tamarack blocks shall contain not less than twenty (20) and the gum blocks not less than twenty-two (22) pounds per cubic foot.

OIL.

The oil used shall be a coal tar product, free from adulteration of any kind whatever, and shall comply with the following requirements:

1. The specific gravity shall be at least 1.10 at a temperature of 38 degrees C.

2. Not more than three (3) per cent. of the oil shall be insoluble by hot continuous extraction with benzol and chloroform.

3. On distillation, which shall be made exactly as described in Bulletin No. 65 of the American Railway Engineering and Maintenance of Way Association, the distillate shall not exceed two (2) per cent. up to 150 degrees C. and 35 per cent. up to 315 degrees C. The mean of three determinations to be taken.

The manufacturer of the oil shall permit full and complete inspection and sampling at the factory at which the oil is produced, of all materials, either crude or refined, entering into the manufacture of the finished product, as well as the finished product itself, in order that the materials used can be determined to be in accordance with the foregoing requirements. He shall also submit satisfactory proof of the origin of all materials entering into the composition of the finished product.

Oil samples taken by the inspector from the treating tank during progress of the work shall at no time be allowed to show an accumulation of more than two per cent of foreign matter, such as sawdust and dirt.

Due allowance shall be made for such accumulation of foreign matter by injecting an additional quantity of oil into the blocks.

CUSHION.

The blocks shall be laid on a sand cushion, one inch in thickness, placed upon the concrete foundation.

FILLER.

The joints between the blocks shall be filled with pitch or fine sand, the particular kind to be determined by the local authorities, as conditions may demand.

EXPANSION JOINTS.

An expansion joint shall be laid along the curb, and transverse joints one-half inch in width every fifty feet along the street, these joints to be filled with a bituminous composition,

the necessity of the transverse joints to be determined by the local authorities, according to climatic conditions.

INSPECTION.

The party manufacturing the blocks shall equip his plant with all the necessary gauges, appliances and facilities to enable the inspector to satisfy himself that the requirements of the specifications are fulfilled.

The committee feels that, while the above specifications are not perfect, by any means, they do represent the judgment of the committee, after a full and careful consideration of the matter in all its details.

The committee wishes to thank the representatives of the different manufacturers for the valuable information furnished the committee, all of which is respectfully submitted.

SEWAGE PURIFICATION FOR THE CITY OF DRESDEN, GERMANY.

By Dr. Robert Grimshaw, Dresden, Germany.

THE works in the Kaditz meadows for purifying and pumping the sewage of the city of Dresden are rapidly approaching completion, by reason of the favorable weather conditions, so that the station can be started some time in 1910. About two and a half years ago the work of digging out was commenced, for the purifying reservoir, about 80 meters long, 30 wide and on the average 10 deep, together with the sewers which discharge into this, and the channels for the discharge of the water therefrom.

This plant has for its object to purify the entire sewage of the city of Dresden from all floating impurities over 2mm (say 0.078 inch) in diameter, before it is discharged into the river Elbe. The foul water is discharged into the reservoir by the two great collecting sewers. One of these, on the Neustadt side, runs in its course from the Albert Bridge to Old Mickten, about parallel to the Elbe; and, from the suburb named, along Scharfenberger street. This sewer receives all the foul water on the Neustadt side of the city. The other, on the Altstadt side, begins at Schubert street in the suburb of Striesen, and follows the river to a point below the Marien Bridge. Here it diverges, runs along Magdeburg street, crosses the Elbe by means of a syphon above the mouth of the Weisseritz stream (that did so much damage in 1897), and passes through Neustadt territory. Here it passes through the Uebigau and Kaditz meadows (in the district in which will be laid the Hochufer or High Bank street), and joins the Neustadt collecting sewer under Scharfenberger street, carrying the entire volume of sewage to the Altstadt, or "old city," side (so called because this is the newer portion of the city!).

After joining, the two collecting sewers deliver the sewage for the first purification, in which, by means of floating beams, iron gratings, etc., the larger floating impurities are kept back. The purification proper takes place in the immense purification plant. In this there are four great separating disks of the Reinsch system, each eight meters in diameter. These are furnished with innumerable slots only 2 mm wide, through which the sewage seeps, and which retain all the undissolved particles over 2 mm diameter. These disks are kept in constant slow motion, and the impurities are automatically removed by brushes and dredged out into cars ready to take them where they are to be used as fertilizers. At first, however, they are stored in a place specially reserved therefor.

The purified water flows in dry weather, or when there is only slight rainfall, through the outlet channel, and is discharged into the Elbe at the middle of its width. If by reason of heavy rains the discharge is abnormally great—say, more than three cubic meters or about 100 cubic feet, per second—then the two rain channels are used, which discharge on the right bank of the Elbe, opposite the steamboat station, Briesnitz-Kemnitz.

If by reason of the rise of the Elbe (which in spring sometimes reaches 14 feet above the so-called "zero" point, that in itself is four meters or about 13 feet above the dredged out steamer channel), the gate valves are closed, and the sewage is pumped into the Elbe direct. The pumping station is about 60 meters long, 20 wide and

10.5 deep. The cement work for the purification plant was ready long ago, that of the pumping station is not yet completed.

The combined earth work and cement work has been done by the Dresden firm of Dykerhoff & Widamann, according to the plans and specifications, and under the direction of the Tiefbauamt or Underground Commission of the city of Dresden. The work of keeping all dry in the deep basins and channels has at times required the work of seven locomobiles, of which at present only two are at work. This work is done by the Tiefbauamt, which also has charge of the various streets and squares in the district in question.

THE COMBINED ELECTRIC LIGHT AND WATER WORKS OF THOMASVILLE, GA.

By Frank C. Perkins, Buffalo, N. Y.

THE light plant at Thomasville, Ga., is operated by the municipality in connection with the waterworks pumping plant.

The electric and engine equipment consists of two generators of 200 kilowatts and 250 kilowatts capacity, belted to Corliss engines. One unit has been operating for three years, and generates current, it is maintained, at slightly over one cent per kilowatt hour, with coal as a fuel at $3.20 per ton.

The street lighting of the city of Thomasville includes 70 enclosed arc lamps of 1,200 candle power, and 50 tungsten lamps of 50 watts each, while the commercial lighting is all operated on the meter system and consists of 10,000 incandescent lamps of 8 or 16 candle-power each.

The boiler room for the combined electric light plant and waterworks is provided with four return tubular boilers, 66x16 with a rated horse-power of 100 each, and all equipped with shaking grates for hand firing. The service has not been interrupted from any cause whatever during the past three years. It is stated by J. A. Epply, superintendent of the waterworks and motive power for the city of Thomasville that the plant is earning some money selling current for 10 cents per kilowatt hour, besides saving the city about $5,000.00 per year for street lighting, over the rate previously paid.

It is maintained that the plant is operated on the eight-hour system as most economical, it not being possible to get the desired results when working men twelve hours every day in the year at the combined lighting and pumping station.

The plant is in charge of a committee of three members of the City Council, appointed by the mayor, and the superintendents are elected by the City Council, every one being hired on the merit system. The electrical equipment is under the charge of Supt. D. E. Pringle.

A COMPARISON OF COST AND EFFICIENCY OF METHODS OF STREET LIGHTING.

By N. R. Birge, Schenectady, N. Y.

IN view of the thousands of dollars annually spent in our cities for public improvements, it is surprising to note in how many instances the public lighting is left to remain as it was a decade ago. These antiquated methods of illumination are not only unprofitable to the stations operating them, but fail to give the public the benefit of the advantages to be derived from the more modern illuminants. When arranged in accordance with present day practice, the later lighting equipments not only provide for the quantity and quality of the illuminants required, but for their esthetic arrangement as well.

In considering the most desirable method of illumination, one must be governed by local conditions, as the

amount of illumination required varies in accordance with the locality. For districts requiring a high degree of illumination, the arc lamp is best adapted. On the other hand, there are districts where the volume of light from the arc is more than is required, or more than can be used effectively, as, for example, where the presence of dense foliage confines the illumination from any one source to a very restricted area. For such localities the series incandescent lamp can be used to advantage. With a combination of arc and incandescent lights the esthetic results are not only enhanced, but an increase in revenue to the operating station is realized. Many incandescent lamps will therefore be added to the circuits of the lighting company in districts that have formerly been left in total darkness on account of the lack of satisfactory and inexpensive units of low illuminating intensity.

In the early days of arc lighting the open carbon arc was such a pronounced improvement over the illuminants then in general use that the details of cost and maintenance were not seriously considered. The advent of the enclosed arc lamp, however, opened up a new field, and since the days of its introduction there has been a steady improvement in its mechanical construction and the quantity and quality of its illumination, with a resulting economy in operation.

In endeavoring to further increase the illuminating efficiency of the arc lamp, at the same time maintaining its simplicity of construction, it became necessary to abandon the use of carbon electrodes for those composed of other substances. This resulted in the adoption and perfection of the "magnetite," or "luminous arc," as most suitable to meet present requirements.

When designing the mechanism of the luminous arc lamp, the most important details to be considered were the method of feeding the electrodes, and their relative positions. Naturally, the first step towards perfecting these important details embodied methods most commonly employed in connection with the carbon arc: viz, a clutch mechanism acting directly upon a composition electrode arranged to feed in a downward direction.

On account of the peculiar characteristics of the arc, this method introduced complications of such a serious nature that it was abandoned for a simpler construction, which not only overcomes the mechanical difficulties formerly encountered, but embraces the advantages derived from the ideal distribution of light rays from the arc. The design has been perfected to such a high degree that more than 25,000 luminous arc lamps are now in successful commercial operation, with results most gratifying to both the general public and the operating stations.

The luminous lamp commends itself to operating managers for the following reasons:

First. The lamp consumes only 310 watts and gives 30 per cent more effective illumination than is secured with a 480 watt carbon lamp.

Second. Electrodes have a life of 175 to 200 hours; consequently, the cost of trimming is lower.

Third. No enclosing globes are required, thus eliminating this item of maintenance.

Fourth. Ideal distribution of light due to the permanent position and character of the arc.

The proper wattage consistent with suitable illumination, with due respect to low operating and maintenance expense, was determined from actual experience, and a current consumption of 4.0 amperes and an arc voltage of 75 was decided upon. A higher or lower adjustment, however, can readily be made, either at the operating station or at the place of manufacture.

Although designed primarily for operation on 4 ampere direct current circuits, the luminous arc lamp can be operated with equal success from an alternating current source by means of a motor generator set or a suitable current rectifier.

The motor generator set, consisting of an alternating current motor driving a direct current series arc machine, is familiar to all operating engineers.

The current rectifier, commonly designated as the series mercury arc rectifier, includes a constant current transformer, series mercury arc rectifier tube, tank for tube, transformer for exciting rectifier tube, and switchboard.

The constant current transformer used with this outfit has the same characteristics as the one used with the well-known series alternating arc systems. The primary windings are connected to a constant potential alternating current supply of any commercial voltage or frequency. The secondary windings are connected to the anodes, or alternating current terminals of the rectifier tube. A tap in the middle of the secondary winding connects the transformer and its direct

current reactance to the negative end of the lamp circuit; the positive end of the lamp circuit being connected through an ammeter to the cathode of the rectifier tube.

The adjustment for the proper current in the lighting circuit is obtained by changing the weights attached to the rocker arm which supports the movable coil of the transformer.

The rectifier tube, by means of which the alternating current is transformed into direct current, consists of an exhausted glass vessel, enclosed in a steel tank filled with oil; the oil being maintained at the proper temperature by means of water cooling coils.

The exciting transformer is used to supply a low potential current to the starting anodes and cathode of the rectifier tube.

The standard series rectifier switchboard consists of blue Vermont marble supported on a pipe frame, the bottom of the panel being above the floor level. The equipment consists of the necessary instruments and switches for the control of the circuit.

Until recently, low frequency alternating current circuits (25 to 30 cycles), without motor generator or frequency changing sets, have been used very little for arc lighting purposes.

However, the rectifier set, which fulfills the purpose of the motor-generator, can be operated at these low frequencies. The first cost of the rectifier set is much lower than that of a motor-generator or frequency changer, the efficiency is higher, and less floor space is required.

The following is a comparison showing the costs of operating a one hundred light open arc system and a one hundred light series luminous arc rectifier system. In making this comparison three distinct problems are considered:

First. Interest and depreciation on the investment.

Second. Maintenance, including cost of electrode renewals, trimming and repairs.

Third. Cost of energy consumed.

INTEREST AND DEPRECIATION ACCOUNT.

Approximate scrap value of 100-light, 9.6 ampere A.C. Open Arc System, including belt driven arc machine, lamps and cutouts		$600.00
Cost of 100-light Luminous Arc Rectifier System, complete with lamps, cutouts, etc., and including generator capacity		$5,700.00
Interest and depreciation at 12 per cent. per annum	72.00	684.00

The cost of the distributing lines has been omitted, as this would be the same for either system.

MAINTENANCE.

Trimming—		
Open arcs are trimmed every day. One man at $50 per month can trim 100 lamps per day, making cost per lamp per year	$6.00	
Luminous arcs are trimmed about 23 times per year of about 4,000 hours. One hundred lamps would require about one-sixth of a man's time, making cost per lamp per year		$1.00
Carbons and Electrodes—		
Open arcs require two carbons per day, or 730 per year, at a cost of $7.50 per 1,000. Cost per lamp per year	5.50	
The luminous arcs require trimming of the lower electrode every 175 to 200 hours, or 23 times per year; the upper electrode every 4,000 to 6,000 hours. Cost of lower electrodes, 5 cents each, and upper electrodes, 55 cents each, making the cost per lamp per year		1.70
Outer Globes—		
A fair allowance would be 30 cents per lamp per year for the open arcs, and 50 cents per lamp per year for the luminous arcs	.30	.50
Repairs—		
This item is difficult to determine on account of varying local conditions, but a conservative estimate based on an average figure would be	2.50	.75
Tube Renewals—		
Cost of tube renewals, based on average		

central station reports, would not be more per lamp per year than.....		3.00
Total maintenance charge per lamp per year	14.30	6.95
Total for 100 lamps...	$1,430.00	$695.00

COST OF ENERGY.

The line loss in each installation will depend on the length of line, but for the purpose of comparison a loss of 10 per cent. at 9.6 amperes is taken as a representative case. Assuming the size of wire to be the same for both systems, the relative losses will be proportionate to the square of the current.

Watts consumed at terminals...	480 watts	310 watts
With a line loss of 10 per cent. and a generator efficiency of 64 per cent., each 9.6 ampere open arc lamp requires 835 watts at the engine shaft, or a total for the system of.....	83,500 watts	
With a line loss of 2 per cent. and a generator and transformer efficiency of 83 per cent., each 4 ampere luminous arc lamp requires 380 watts at the engine shaft, or a total for the system of..		38,000 watts
Burning 4,000 hours per year, with the cost of energy at 1½ cent per kilowatt hour, the cost per lamp per year would be.....	$50.10	$22.80
Total for the system	$5,010.00	$2,280.00

SUMMARY.

Interest and depreciation	$72.00	$684.00
Maintenance	1,430.00	695.00
Energy	5,010.00	2,280.00
Total for 100-light system...	$6,512.00	$3,659.00

This shows an annual saving in favor of the luminous arc rectifier system of $28.53 per lamp, or a total saving per year of $2,853.

Therefore, the total net investment of $5,700 for the luminous arc rectifier system will be paid for in about two years, after which the net annual saving will create a dividend of more than 50 per cent. on the new investment.

Parallel with the improvement of series arc lamp efficiency, rapid progress was made in the development of the series incandescent lamp. The first series incandescent lamps were placed in service in 1880, and were operated in series with open arcs supplied from arc dynamos, but these incandescents were crude, inefficient and short lived.

It was about fifteen years later that the manufacturers realized that to improve the operation of these lamps and produce a satisfactory system for street lighting the developing of a suitable regulating device was essential. During this period the bank board system was first introduced. This was followed by the shunt box method of regulation, and still later by the reactive coil; but it was not until 1902 that the constant current transformer was commercially introduced as a means of regulation.

The advantages of the constant current transformer over other methods of regulation are:

First. The absence of a grounded secondary or circuit line.

Second. Since the life of the lamp depends largely on the regulation of the lighting system, the close regulation of the constant current transformer reduces lamp renewals to a minimum.

Third. The constant current transformer, which combines the step-up transformer and reactive coil, avoids the necessity of two separate pieces of apparatus and reduces the amount of floor space required.

Some of the old systems mentioned still occasionally enter into competition with the constant current transformer because of a slightly lower initial cost of installation. They lack, however, many of the essential features necessary for an efficient installation, the most important of these being close regulation. Past experience has proved that with each improvement in regulating apparatus a corresponding improvement in the life of the incandescent lamps has resulted.

The first series incandescent lamps were of an efficiency of about 5 watts

per candle. Improvements in lamp manufacture produced a 4 watts per candle lamp, and later a 3.5 watts per candle lamp giving better life results; and only a few years ago the GEM metallized filament lamp was introduced, with an efficiency of 2.7 watts per candle. The introduction of the tungsten lamp has been the latest step in advance, giving us a lamp of 1¼ watts per candle, which efficiency is maintained practically constant throughout a life of from twelve hundred to fifteen hundred hours.

The following is a comparison showing the cost of operating one hundred 40-candle-power carbon filament, GEM filament, and tungsten incandescent lamps:

COST OF ENERGY.

The carbon filament lamps are assumed to have an efficiency of 3½ watts per candle-power; the GEM filament lamps, 2.7 watts per candle-power, and the tungsten lamps, 1¼ watts per candle-power. Assuming that the lamps burn 4,000 hours per year, and that the energy costs 1½ cents per kilowatt hour, the cost for 100 lamps would be:

Carbon filament lamp	$840.00
Gem filament lamp	648.00
Tungsten lamp	300.00

(These figures do not include loss in transformer or generator.)

COST OF RENEWALS.

Number of renewals	4	4	3
Price of lamp	$ 0.493	$ 0.553	$ 1.215
Cost of renewals per 100 lamps	197.20	221.00	364.50

The total cost of 100 lamps, including energy and renewals, would be:

Carbon filament lamp	$1,037.20
Gem filament lamp	869.00
Tungsten lamp	664.50

The saving in favor of the tungsten lamp would therefore be:

Tungsten over Gem—
$204.50, or $2.05 per lamp per year
Tungsten over Carbon—
372.00, or 3.73 per lamp per year

The station equipment for any series incandescent system may be a part of the series arc lighting outfit previously described, with the lamps in series with the luminous arc lamps; or it may be entirely separate. The former arrangement is generally the one employed in large towns and cities where both arcs and incandescents are used, and the latter in smaller places where only the incandescents are required.

For installations consisting entirely of incandescent units, the constant current transformer has been standardized for a primary voltage of 1,100 or 2,200 volts, and frequencies of from 60 to 125 cycles, in capacities of 4, 8, 16, 22 and 32 kilowatts. Special transformers, however, can be built for almost any primary voltage, frequency or kilowatt output. The standard secondary or line current adjustments are for 3.5, 4, 5.5 and 6.6 amperes, although 1.75 and 7.5 ampere transformer can be furnished if desired.

Tungsten lamps have been designed for 25, 32, 40 and 60 candle-power, for standard current adjustments. In addition, higher candle-power lamps are being developed, and may possibly be had in the near future, in sizes of 80, 100 and 200 candle-power.

Various arrangements for the suspension of these small units have been perfected, the latest and most popular of which is the ornamental bracket fitted with a radial reflector. This reflector serves the double function of protecting the lamp and of directing the rays in the most efficient direction, thus increasing the effective illumination about 20 per cent. The brackets are mounted on poles placed on alternate sides of the street at equal distances apart, and so arranged that the lamp is suspended about four feet out from the curb. The proper height of the suspension depends on the intrinsic brilliancy of the illuminating unit, the distance between the poles, and the necessity of minimizing the shadows from foliage. In determining the height, care should be used to suspend the unit so that the rays of light will not shine directly in the eyes of persons approaching, but not so high that the foliage will intercept the rays.

Although the effect of gas illumination with Welsbach mantles is, under ideal conditions, similar to the incandescent unit of small illuminating intensity, the esthetic effect is less impressive. The wide variation in candle-power during the life of the mantle is also objectionable, while the cost of operation is in favor of the series incandescent system. For these and other reasons of less importance, the use of gas for street illuminating purposes is being rapidly replaced by the more modern system of series incandescent lighting.

The following table, compiled from results obtained from actual tests, serves to show the wide variation of candle-power during the life of a Welsbach mantle:

City	Maximum Candle-Power	Minimum Candle-Power	Average Candle Power
(1)	55.0	21.5	36.7
(2)	25.0	6.5	16.8
(3)	55.1	16.3	27.8

In making a suitable comparison of the operating costs of the Welsbach mantle and tungsten lamp, it will be necessary to take the 60 c.p. tungsten lamp, as the Welsbach mantles are rated at 60 c.p. Basing the comparison on 4,000 hours yearly burning, and allowing three renewals per year for tungsten lamp, the following results are secured:

One 60 c.p. tungsten lamp consumes 75 watts, and when operating 4,000 hours per year, requires 300 kw. hours.
300 kw. hours, at 1½cents per kw. hour $4.50
Three renewals at $1,215 each.... 3.65

Total cost per lamp per year...$8.15
One 60 c.p. Welsbach mantle consumes 3½ cubic ft. of gas per hour, and when operating 4,000 hours per year, requires 14,000 cu. ft.
14,000 cu. ft. at $.75 per 1,000 cu. ft. $10.50
Maintenance at 3 cents per night (365 nights)..... 10.95

Total cost per year.....$21.45
Net saving in favor of the tungsten lamp.....$13.30

At 50 cents per 1,000 ft. for gas, a saving of $9.80 is shown in favor of the tungsten lamp.

Special emphasis should be laid on the fact that the candle-power of the tungsten lamp is practically the same throughout its life, while the gas mantle loses about 25 per cent. of its initial candle-power in the first 100 hours, and at the end of 1,000 hours is furnishing only 25 or 30 per cent. of its rated candle-power.

It is evident from what has been said that electric light is the most economical form of street illumination; that the luminous arc is the best lighting unit for general city street lighting; and that the series tungsten incandescent is most satisfactory for suburban lighting and lighting in other localities where conditions demand a unit of minor intensity.—*General Electric Review.*

THE ARTESIAN WELLS OF THE WATER SUPPLY OF MEMPHIS, TENN.

THE city of Memphis, Tenn., has a unique system of water supply which is very satisfactory under the local conditions, but those conditions are so peculiar that it will seldom be possible to apply the same principles in other cities.

The beginning of the system was by accident, a manufacturing concern putting down a well to obtain water for condensing purposes striking a stratum of water with head enough to produce a flowing well. This occurred in 1887. Prior to that time, beginning as early as 1870, attempts had been made with little success to procure satisfactory water from surface sources, most of the reports on the subject casting doubt on the practicability of well water for a city system.

On the discovery of the artesian well the Artesian Water Company was formed and shortly consolidated with the Memphis Water Company, which had been struggling with a surface water supply.

One well not being sufficient, others were driven, and, these wells relieving the pressure on the underground supply, the wells ceased to flow at the surface, but continued to flow at a greater depth. These facts resulted in the construction of an underground reservoir in the form of a tunnel, into which the wells discharge, and from which the pumps raise the water. As the capacity of the works increases parallel with the demand, the number of wells must be increased, until ultimately the resulting reduction in the head on the underground reservoir reduces the flow so that the curves of consumption of water and capacity of wells intersect. The location of the underground tunnel reservoir is evidently very important, for if it is near the surface of the ground the capacity of the system will be reached more quickly than if it is deeper. But depth means expense in construction and operation.

The original pumping station is located in the northern part of the city, and there are now about 65 wells connected with the tunnel, which is 5 feet in diameter, about a mile long, and

from 70 to 95 feet below the surface of the streets under which it is located. The tunnel has a variable fall toward the pumping station of about 0.1 foot in 100 feet. The wells are connected with this tunnel through a total length of about 5½ miles of wood-lined drifts, each about 30 by 41 inches, which can be shut off from the tunnel. The wells are driven from the surface about 300 feet down through an impervious stratum of blue clay, and there reach a bed of fine sand about 150 feet thick. Several wells are over 500 feet deep, and one is over 600 feet. A second stratum of coarse sand is found at about 550 feet depth. At the beginning 43 wells were driven, all of which are now out of service. In all 159 wells have been put down, of which about 70 are now active, including 5 at the new east end station.

The standard construction of a well is first to drive a 13-inch pipe into the blue clay until the level of the tunnel is passed, thus casing off all water which may come from above. A 10-inch pipe is then driven inside this 13-inch pipe until it reaches the water-bearing stratum. The strainer running into the sand stratum is 50 feet long. The 10-inch pipe is connected with one of the drifts in the tunnel, which can be shut off so that the well can be isolated while being cleaned or when it is abandoned.

A good new well has a capacity of 800,000 to 1,000,000 gallons a day. Its capacity drops to about 500,000 gallons during the first 18 months, and then gradually declines to zero. There are several methods of cleaning wells and increasing their capacity.

1. Water at city pressure is turned into it, and is forced out through the strainer slits, opening up the sand to some extent. This method of cleaning will work for say two years.

2. Mr. Carl E. Davis, the resident engineer of the plant, to whom we are indebted for the information regarding methods of operation, has devised a special tool which restricts the application of the back water pressure to one foot of the strainer at a time, and the tool is gradually moved from one end to the other of the strainer. This method adds about another year to the life of a well.

3. The strainer may be removed entirely and the well washed out by water pressure, the strainer being then returned to the well.

4. The well is telescoped deeper in the sand, so that another part of the layer is put in use. As the sand layer is 150 feet deep and the strainer is 50 feet long, this can be done more than once.

5. When these methods all fail, a new well is driven. One driven 22 feet from the old well is as good as the original well.

Five or six years is the ordinary life of a well, and it will yield from 50,000 to 75,000 gallons a day for several years more. One well yielded 250,000 gallons a day for 15 years, and then stopped rather suddenly.

The study of the capacity of the wells is very fascinating. It depends on a number of variable quantities. Datum is 70 feet above the bottom of the tunnel at the pump well. The level of water in the wells fluctuates between points 5 feet above and 9 feet below the datum, due to the variations in pressure in the water-bearing sand stratum. The pumps draw down the water in the pump well in the day time 40 to 48 feet below datum as a minimum, and about 60 feet as a maximum. They draw the water down say 26 feet at night. The maximum is getting quite close to the top of the tunnel, which at its highest point is less than 65 feet below datum.

Capacities of wells are estimated at present for a draft on the pump well of 50 feet below datum. Each month a meter is dropped into each well and the flow is measured. The rate of flow shown by the meter at the accompanying draft is reduced to 50 feet draft and compared with the flow for the previous month. Accounts are kept with all the wells. Following is the record of one representative well:

December 29, 1908.....263,000 gallons
January 26, 1909.....227,000 gallons
February 26, 1909.....252,000 gallons
March 30, 1909.....208,000 gallons
April 27, 1909.....194,000 gallons

Well overhauled:

May 28, 1909.....495,000 gallons
June 30, 1909.....490,000 gallons
July 27, 1909.....420,000 gallons
August 31, 1909.....229,000 gallons
September 28, 1909.....165,000 gallons

Other wells when overhauled were increased in capacity 116,000 and 220,000, and one flushed with the special tool was increased 113,000 gallons.

A well which was discharging 82,000 gallons June 30 was telescoped to greater depth and discharged at the rate of 820,000 gallons a day on August 31.

Occasionally the tool-flushing results in a reduction in the flow in a well. Seven of the 57 wells tool-flushed in 1908 had this result, although the net increase in flow in the 57 wells was

5,379,000 gallons. The changes in flow ranged from a loss of 30,000 gallons in each of two wells to an increase of 440,000 gallons in one. Fifteen wells were overhauled in 1908 with an increase in flow of 1,717,000 gallons, the increases in the wells ranging from 27,000 to 261,000 gallons. Eleven wells were telescoped with a resulting increase in capacity of 5,528,000 gallons, the increase per well ranging from 50,000 gallons to 828,000, the latter being one of five which were not discharging any water prior to the telescoping.

Mr. Davis is making a study of the wells in groups, having divided them into four sections.

The present pumpage of water at this station is about 11,000,000 gallons a day. The pumps could draw for a few hours at the rate of 17,000,000 or 18,000,000 gallons a day.

On account of the growth of the city to the east and south, extensions of pumping capacity are made at two new stations. One at the east end now has five wells with a total capacity of 7,500,000 gallons a day. One of these is a 13-inch well, driven in 1908, which has a capacity of 3,000,000 gallons a day. The success with this well has been so great that it is now proposed to sink nearly all new wells of this size. Only this one well was added to the system in 1908.

The water at this station is raised by compressed air and the wells are 1,000 feet apart to prevent interference of one well with another. The wells are located in the streets where standpipes would be objectionable, and the tops of wells and station are on almost the same level. A unique device is provided for escape of air. It consists of a trap in the form of a tank 8 feet in diameter and 6 feet high, placed on top of the well and under the surface of the street. The 10-inch well projects up into this tank and the 8-inch discharge pipe also, but to a less height. The 2½-inch pipe carrying the air for the air-lift enters the tank and drops down the 10-inch well, lifts the water up into the tank and forces it out through the 8-inch discharge pipe to the collecting main in the collecting basin at the pumping station. Out of one side of the tank, near the top, comes an air pipe, which discharges in a vault at the sidewalk level. This pipe has a relief valve which is weighted so that the pressure of the air in the tank will be sufficient to force the water to the pumping station, and permits the excess of air after this pressure is reached to escape into the atmosphere. The water reaches the collecting basin entirely free from air, and the loss in efficiency is small. This station has five 1,000,000-gallon pumps and one 2,000,000-gallon pump, and pumps about 1,250,000 gallons a day.

Another branch at South Memphis has two small pumping stations of 4,000,000 gallons total capacity and pumping about 600,000 gallons a day.

It should be noted that the city of Memphis purchased the water works system in 1903.

LOWERING WATER LEVEL IN WELLS OF FRANKFORT, IND.*

By J. B. Marvin, Engineer and Superintendent of Frankfort Water Works Company.

AT certain low levels in and around Frankfort the water flowed as late as 1890. It was observed, however, prior to that date the head of the ground water was gradually receding. My concern was rendered acute on the water supply question, made so by having in charge the management of the waterworks at Frankfort during these years.

The water supply is obtained from a coarse gravel and sand stratum reached at a depth of fifty feet at the point where the waterworks are located near the center of Frankfort, and continuing to a depth of eighty feet, thus giving thirty feet of most excellent water-producing gravel and sand. Immediately above this stratum lies twenty feet of blue impervious clay; below is found a greater thickness of the same kind of clay. These conditions prevail throughout a large area of our section, the water-bearing stratum varying somewhat in thickness. From this it would appear that the supply of water in this locality was reasonably well assured. However, I

*A paper before the Indiana Sanitary and Water Supply Association.

have no theory to exploit, either scientific or theoretical, as to the ultimate permanency of the supply, nevertheless I have a decided opinion. I know that by 1892 the head of the water had fallen to a depth where it was necessary to use artificial means to aid the flow.

At this period of the declining ground water level, compressed air was employed to accelerate the flow of the water, and the same was used with varying degrees of success until 1907, and abandoned at that time on account of the ineffectiveness of the method and in consequence of the excessive cost, but most of all, the never ending trouble caused by an offensive odor and disagreeable taste in the water. Be it here understood that at no time prior to the using of air was there even a suggestion of trouble from algae, and it entirely disappeared with the discontinuance of the use of air. During the period air was used our storage consisted of two reservoirs of brick construction, puddled on the outside with blue impervious clay and water-proofed within; bottoms made secure, both reservoirs covered and never neglected in the point of being regularly cleaned. Mention is made of the reservoirs and their construction and condition so that it would be self-evident that the presence of algae in the water could not be charged to sunlight. Often in the autumn months the offensiveness, both to taste and smell, was almost past endurance, and even in the winter months the odor and taste in the water could be readily detected at the hot water faucet. At the time of the greatest distress a suggestion was offered to very high authority that the trouble might be traced to the compressed air, that is, that the fungi might be carried in from the open atmosphere with the compressed air and their growth encouraged and propagated by the warmth imparted by the frictional heat. At that time the suggestion met with a strong negative opinion.

Since then this theory has been under the expert's scrutinizing investigations, and it has been conclusively demonstrated that certain forms of algae live and thrive best without light, and when once imparted to the water find congenial elements for growth in the dark recesses of the water mains. It is a demonstrated fact that our trouble came from the compressed air source, for, as stated before, there was no trace of algae prior to its use, and they entirely disappeared with its discontinuance.

A somewhat extensive experience in other fields, not only in this, but other States, has convinced me that compressed air is a breeder of trouble, that in almost all cases, if not every case, where compressed air is employed for raising water, the presence of algae in some form and to some extent can be found, and this whether the storage is covered or open.

The ground level of the water has lowered about one foot per year during the last twenty years; at first more rapidly, of late very slowly, until at present the static head is twenty-six feet. It seems certain that the next twenty-four feet to the point of the beginning of the water-bearing stratum will offer stubborn resistance to further decline, on account of the large area that supports this subterranean supply. The statement of "large area" is made for the reason that this stratum is drawn upon for water all over Clinton County, and the uniform lowering of the head is well observed.

Deep well augur or impeller pumps, driven by vertical electric motors, direct connected, have been in use since February, 1907; one six-inch and one eight-inch being sufficient to furnish the present requirements. Before installing these pumps nineteen wells were used. A sufficient supply can be obtained now by running the eight-inch pump from 6 o'clock a. m. to 6 o'clock p. m., delivering 700 gallons per minute, and the six-inch pump from 6 o'clock p. m. to 6 o'clock a. m., delivering 408 gallons per minute. The six-inch pump has sixty feet of shafting and requires nine and nine-tenths horse-power for operating, using $3.00 per ton R. M. coal. The fuel cost per thousand gallons for raising water into storage reservoirs, based upon a daily average pumpage for 1909 of 755,756 gallons, was 2 9-10 mills, or 22 horse-power for twelve hours, and ten horse-power for twelve hours, an average of sixteen horse-power.

The last year compressed air was in use, with the static head of the ground water very much higher, the fuel cost per thousand gallons for raising the water into the same reservoirs was 4½ mills. A Rand Duplex Air Compressor with Myer gear was used, the size of the steam cylinders being 12x16 inches, air end 14x16 inches, having a capacity of 570 feet of free air per minute at 100 revolutions with 60 pounds of air and 80 pounds of steam pressure.

HIGH TEMPERATURE GARBAGE AND REFUSE DESTRUCTORS.*

By Col. W. F. Morse, Consulting Engineer, New York City.

WHEN a municipality has determined to adopt a modern scientific method for the disposal of its waste, the preliminary work of an examination of the local conditions, estimates of the quantities to be dealt with, and an approximate analysis of their composition, is the first step to be taken. As a rule, American municipalities do not attach sufficient importance to this subject of waste disposal and are therefore without accurate data except in a few instances; but with the information now at hand, any city engineer can obtain for himself a knowledge of the quantities and the seasonal variations, can make an analysis of their composition and obtain an idea of the total volume such as is necessary for estimating the size of the disposal apparatus that would be most suitable for the special conditions.

Once the preliminary work is completed, it then becomes necessary to determine which of the several methods now in use in this country will be the most satisfactory and economical for the purposes of the city. There are two methods employed. The first one is reduction, meaning the digestion of the garbage and putrefactive matter by a steam process in large iron tanks, the recovery of the oil or grease for the market, and the treatment of the residual called tankage, as a base for fertilizer. Since a reduction works frequently gives off offensive odors, it is not advisable to locate one near a populous district, and therefore this method is handicapped by the cost of the long haul. Further, by this method the problem of disposing of the city's waste is only partially solved; there still remain to be taken care of the household ashes, which always contain a large percentage of combustible material, and the general rubbish, which consists largely of paper, excelsior, wooden boxes, old rags, and a great variety of materials which are combustible. Under this method (reduction) the ashes and rubbish must be placed by the householder in separate receptacles from the garbage, and must be collected in different forms of carts by the scavenging department, thus requiring two, or generally three, visits to each house before all of the waste can be removed. The ashes under this method are generally used for filling low land, without any attempt to utilize the combustible material, and the general rubbish, when not dumped upon vacant land, must be disposed of in a central rubbish burning plant.

The second method, and the one in use in the largest number of instances, is the cremation of all the waste by specially designed destructor furnaces, which are placed at a central point selected with a view to requiring the minimum length of haul for the collecting wagons. This point should always be near to the heart of the most densely populated portion of a city, and can only be chosen when the furnaces are of modern design and can, therefore, be relied upon to operate without nuisance or offense to the neighborhood.

For twenty years American municipalities have been destroying garbage only, separated from the refuse and ashes, by the use of crematories and incinerators. There have been built upwards of 225 of these furnaces, of which more than one-half have been found unsatisfactory and inefficient in operation and have passed out of use, and the remaining number are rapidly being set aside in favor of a more scientific and efficient apparatus for destruction by fire.

Recognizing the limitations of the imperfect combustion of waste by crematory methods, there has lately been introduced another and far more powerful form of cremating furnaces called destructors, which deal with all classes of city waste taken as a whole without any attempt at separation. Manifestly the advantage of such a comprehensive system is vastly greater than one which would be limited to a destruction of only a part of the municipal waste, leaving the remainder to be dealt with by other means, and at additional cost.

The destructor system originated in England more than thirty years ago as the outcome of a situation which compelled the destroying of the town's refuse by fire, owing to the limited area for its disposal in the neighborhood of the cities.

Actually originating in London, it

*A paper before the American Society of Municipal Improvements.

was afterwards put to a thorough trial in Manchester, where the advantages of the new method were fully demonstrated. From this beginning it has grown into general use in Great Britain, there being at the present time something like 300 municipal destructors of some six or eight different types or makes in use. This method is the only one employed for the disposal of the city's waste except in one or two isolated cases where the towns, being on the seaboard, have an opportunity of disposal by sea dumping.

The gradual evolution of the destructor proceeded from the first crude form of cell furnace, through a process of development which included a supplemental fume crematory, and led ultimately to the adoption of powerful forced draft at high temperature and the introduction of large steam boilers in direct connection with the furnace. These improvements were the gradual growth of twenty-five years, and at the present time may be said to be the most satisfactory, efficient and sanitary method for the disposal of all public waste that is known to the civilized world.

In this country we began twenty-five years ago by the erection of a crude form of cremating furnace, continued this in many places and under various conditions and difficulties, and we have persisted in repeating the same general form of construction with but few minor changes, down to the present time. This is the form of American crematory, or incinerator, which has been not entirely satisfactory in public service. About three and a half years ago the introduction of the British form of destructor was first made in Westmount, near Montreal, after an extended examination by competent engineers, and the first destructor was erected and put into operation in the spring of 1906. The results reported from this destructor were in all respects entirely satisfactory as regards efficiency, sanitary operation and reasonable cost for operative service. Following this a destructor of a similar type was installed in another Canadian city, Vancouver, B. C., and a still larger installation was made in one of the boroughs of New York City, Richmond, Staten Island. About the same time one of the larger western cities (Seattle) installed a destructor, and one of the great industrial companies, the General Electric Company at Schenectady, built a destructor for the disposal of the refuse from its works. These five installations, covering a period of about three and a half years, have so firmly established the destructor method that other large cities have, after a prolonged investigation, adopted this method and have issued specifications calling for the construction of large plants within thickly settled parts of the municipalities. One of the western cities (Milwaukee) has now under construction a destructor plant for the disposal of three hundred tons daily, while Buffalo is constructing a forty-ton addition to the present works, the new part being designed on modern destructor lines.

It is a very significant fact that in every one of the five instances, viz., Westmount, Seattle, West New Brighton, Vancouver and Schenectady, where the destructors have been in operation a sufficient length of time to demonstrate their value, they are now advocating the construction of additional units for the disposal of larger quantities and the obtaining of greater steam power. All of these installations are built upon lines similar in construction and in operation.

A destructor must fulfill its initial purpose, which is the disposal of waste and offensive matter without nuisance and at reasonable cost. In doing this whatever results that may be obtained from the combustion are to be regarded as an asset which will return a revenue to the city. The American crematories do not succeed in obtaining any revenue from their works and consequently the disposal of a part of the waste only—the garbage—is accomplished at the expense of a considerable amount of fuel and labor which is a total loss to the city. The destructor in its work develops a volume of heat which is sufficient to operate large steam boilers, which power is in turn applied to the purposes of the city for electric lighting, pumping water, sewage or other municipal uses. Furthermore, the product or residual resulting from disposal by the high temperature destructor is in itself a valuable asset, and supplies the place of broken stone or other material when employed for concrete work.

The advantages to be derived from the introduction of the destructor system as compared with the crematory system may be included under the following headings:

First. The sanitary operation of the destructor is far more efficient than that of the crematories. Nuisance from the disposal of waste by fire comes from the chimney because of low temperatures. The crematories do

not as a rule attain a temperature higher than 1,500 degrees at the fire box, and as these gases pass to the chimney they become cooled until at their exit they frequently fall below 350 degrees, thereby creating odors from their stacks. The combustion of garbage or any form of household waste which contains organic matter must be accomplished at a temperature high enough to destroy not only the material left itself, but the gases thrown off from its combustion. This minimum temperature is fixed by many prominent authorities at 1,250 degrees Fahr. Manifestly any system which falls below this temperature will discharge into the atmosphere a noxious compound of empyreumatic gases, which will fall to the ground and create nuisance. The destructor proceeds on a different plan. The initial temperature at the fire box approaches 2,000 degrees Fahr., and in its passage through the combustion chamber this is increased and maintained at from 2,000 to 2,500 degrees Fahr., thereby insuring the absolute destruction and conversion to CO_2 of all organic compounds.

Second. The production of high temperatures in the destroyal of all mixed waste of the city, assures that a steam boiler can be kept in operation during the time the waste is supplied. This is accomplished by the use of a forced draft under the fire bars, derived from the passage of air through a re-generator, or preheater, by which it is raised to a temperature of 350 degrees before being introduced under the fire box. The result of this process is the production of a volume of heat, which, when passed through a boiler, gives a constant high steam pressure and insures the operation of machinery which may be attached thereto at a uniform rate.

Third. The advantage in the destructor system is the incineration of the waste to such a degree as to absolutely destroy every form of organic compound or combustible material, whether solid or gaseous, and reduce the residual to a clinker, vitreous and solid in character, capable of being broken up for use in concrete and other work, or it may be used for the manufacture of bricks or tile for municipal purposes. The clinker produced by a destructor is everywhere recognized as an asset and gives a return in money of greater or less sum according to the demand for its use.

Fourth. The advantage of a destructor system is in the fact that its installation may be made at a point within the limits of the city itself and not far removed from the collection district. The moving of a ton of garbage by the agency of a team of horses and men one mile, costs in the neighborhood of 75 cents to $1. When this is multiplied by a large number of teams over a long period of time the expense becomes very great. By the erection of a destructor at some central point where the transportation is reduced, the cost of the service is very greatly diminished. A destructor centrally located, operating without nuisance, developing power for municipal purposes, and using its by-product of clinker for municipal work, has very many advantages over the former method of cremating the garbage only at a point far removed from the city itself.

Fifth. The collection of the waste of a municipality is one of the greatest expenses in connection with the city government. The present practice of making a separation of the wastes involves an expense to the householder for equipment and for service which in many cases is very onerous. Where there are three separate collections of garbage, refuse and ashes there must be maintained three separate vessels with all the attendant care required. The single method of collection, unsorted and unseparated, is much to be preferred to the usual method obtaining in this country. If a load taken from a household includes all the waste of every character from the house, it is done at one operation and at one time, and with a much greater economy of labor than if there were three services performing the same work. The usefulness of the destructor system is found in the fact that the householder may at once eliminate from his premises every form of waste by one service, and it is then brought to the furnace and destroyed without any separation and with the greatest economy in time and labor.

The experience of the past four years in the introduction of the destructor system in this country has thoroughly demonstrated its satisfactory operation as demanded by the boards of health in point of sanitation; by the city authorities in point of economy; and by the city engineers in the production and application of steam power. Thus it is that some of the largest cities in the country are now introducing this method under the advice of experienced and compe-

tent engineers, who have investigated the question of the disposal of waste in every part of the civilized world, and have recommended the destructor system as being the most efficient and most economical known.

For an average American city of 100,000 population it would be fair to assume an estimated daily waste of 130 tons of mixed refuse per day, which would be collected by the scavengers and delivered to the destructor plant. This would comprise all the garbage, rubbish and ashes from residences, but not from power plants or factories. For such a city it would probably be best to build one central plant located in the most populous portion of the city, so that most of the material would be subject to short haul, enabling each cart to make several trips a day except to the outlying districts.

The cost of a plant to consume 130 tons per day would be from $110,000 to $130,000, depending upon the elaborateness of the buildings for housing the destructor, or would average about $120,000 without real estate. At the average rate of wages the operating cost of such a plant would be 35 cents per ton for the refuse consumed, or $45.50 per day. A conservative estimate of the amount of steam which would be produced under high pressure in a boiler by the heat from such a plant would be 32,500 pounds per day, which would be equivalent to 20 tons of coal, which at $3 per ton would be worth $60 per day. There would also be at least 40 tons of clinker delivered from the plant, which, if sold at 50 cents a ton, would yield a revenue of $20 per day. The coal and clinker would, therefore, give a credit to the plant of $80 per day, leaving a balance of $34.50 per day over operating expenses amounting to $12,601 per year. If the plant costs $120,000, a fair allowance for interest, repairs and sinking fund would be $12,000 per annum, leaving a net annual income of $601 which this plant would earn. Stated in tubulated form, the figures are as follows:

FINANCES OF PLANT FOR 100,000 POPULATION.

Population		100,000
Estimated daily waste, tons mixed refuse		130
Cost per day of plant to consume this amount, $110,000 to $130,000, averaging about $120,000.		
Cost of operation at average wages, 35 cents per ton, $45.50 per day.		
Revenue from 32,500 lbs. steam equivalent to 20 tons coal per day, at $3.00	$60.00	
40 tons of clinker at 50 cents	20.00	
	$80.00	
	45.50	
Profit for year 365¼ × $34.50		$12,601
10 per cent. to cover fixed charges (interest 5 per cent., repairs 1 per cent., sinking fund 4 per cent.)		12,000
Net annual income		$601

This is not an unreasonable expectation and there are possibilities for greatly increasing the revenue by utilizing the steam for more valuable purposes, or by selling the clinker at a higher price than 50 cents per ton. Steam generated from such a plant, wherever a steady load is carried throughout the day, can be used for pumping water or for pumping sewage, or for making ice. This last means of disposal of steam is particularly appropriate since the steam generally delivered from a destructor is just about of sufficient quantity to furnish the average amount of ice consumed by a community of the size which the destructor is capable of serving, when the ice is manufactured by the absorption process. The clinker may also frequently be sold for considerably higher price than 50 cents per ton. It is in great demand for building purposes, being better than cinders for mixing in concrete for floors or partition walls.

The advantages of the short haul, which this method enables, furthermore serve to reduce the cost of collection about 30 to 40 per cent. Assuming that it cost the city $1.50 a ton to make collections by other methods and $1 per ton when destructors are used, the saving of 50 cents a ton, amounting to $23,733 per year, should be added as a direct credit to the destructor system.

These figures will serve to demonstrate the claims above made that, having first met the sanitary requirements by adopting the high temperature destructor system, a city also has it within her grasp to adopt a system which is more than self-supporting, and, therefore, the most economical.

EDITORIAL COMMENT

The Organization for Standardizing Paving Specifications

Qualifications of Engineers and How to Determine Them

THE ORGANIZATION FOR STANDIZING PAVING SPECIFICATIONS.

There have been so many more or less unsuccessful efforts to arouse interest in standard specifications of various sorts among municipal engineers that no one was prepared for the enthusiasm which was manifested at the meeting which was called by the Mayor and the Department of Public Works of Chicago for the purpose of formulating standard methods of paving streets.

Some of this interest was fore-shadowed in the recent convention of the American Society of Municipal Improvements at which one of the most important steps that organization has taken in years was made by appointing a general committee on standard specifications with instructions to appoint special committees to prepare and present specifications for all classes of municipal work. Considerable enthusiasm was shown among the members of this staid, easy-going organization and the committee has been appointed and is about to begin its work.

But its movements are too slow for pushing Chicago and one of that city's officials, who does not happen to be an engineer and perhaps thought himself not eligible to membership, did have an assignment upon a committee to revise the Chicago street construction specifications in time for the season of 1910 and, unusual as that may seem, wanted to know what other cities were doing. He soon found out that no two of the larger cities were doing the same thing, and then he asked for the convention. He made his request early in February and a week's almost continuous session was ended on the second of March. This was quick work, and good work too, for he had representatives from the construction departments of 41 cities and four of the five members of the general committee of the American Society of Municipal Improvements. Of the 44 cities having over 100,000 population 26 were represented; 7 of those of 50,000 to 100,000 population; 4 of 30,000 to 50,000 population and 4 of still smaller size, although the first formal invitations were sent to the cities of more than 100,000 with a few additions.

It was a working convention. Large committees were appointed, who assigned special subjects to sub-committees, and by applying themselves strictly to business were able to present excellent reports at the sessions of Thursday, Friday and Saturday. Some of these reports are printed in this number of MUNICIPAL ENGINEERING and others will follow in the May number.

The convention early decided that it could not settle all the questions presented to it in one meeting, and made arrangements to meet again in January, 1911, in New York City, to take up the questions which were given only tentative answers and those to which no answers were given.

The name adopted for the rather loose organization which was formed is "Organization for the Standardization of Paving Specifications" and is very appropriate, for it indicates the purpose of the convention and its extension into next year. Two or three meetings under programs in accord with this name and purpose will very nearly fulfill the ends of its existence and then it must either die, combine with some other organization or expand its field.

So much energy as is here manifested should be kept busy, and one of the latter alternatives should be chosen.

The American Society of Municipal Improvements is an organization with many years of most excellent work behind it, one branch of whose work includes the objects of the new organization. Most of the cities represented in the new organization are members of the older one. Many individuals are members of both. Their objects are the same and the older society supplies the larger field which the new organization must expand into if it is to continue its existence indefinitely. Both organizations are equally free from entangling alliances of any kind. Whether considered from the standpoint of the new organization with its present name and purpose or with a desire for expansion, therefore, alliance with the older organization is desirable. Now that the special purpose for which the convention was called, the revision of Chicago paving specifications, has been accomplished, the organization can very properly transfer its activities to the existing association covering the whole municipal field. The American Society of Municipal Improvements should welcome the new blood and the new enthusiasm which its own members have imbibed from the new organization. It needs some of the snap and energy so well exhibited at Chicago.

The proposal for an alliance was presented to the executive board of the new society after the adjournment of the convention at a meeting at which five members of both societies were present, and a committee was appointed to meet with the American Society of Municipal Improvements in October at Erie, Pa., and still further consider the matter.

QUALIFICATIONS OF ENGINEERS AND HOW TO DETERMINE THEM.

The inquiry in the "Question Department" concerning the method of securing good bridge plans, the occurrences mentioned in the answer, the paper on "Engineering Ethics" which F. H. Snow, Chief Engineer of the Pennsylvania Department of Health, presented to the Pennsylvania Society of Engineers, and the procedure of state health departments regarding the qualifications and reputation of engineers having business therewith suggest some subjects for consideration which are becoming daily more important to engineers and to the public.

It has long been a matter of chance in all but the largest cities, and sometimes in them, whether a good engineer was obtained, and the successive consulting engineers and commissions sitting on the same proposition have not seldom seen the decision made in spite of the technical advice, good, bad and indifferent which has been offered. The number of educated engineers has increased quite as rapidly as the population, but they have not had the self-protective spirit and, instead of combining to better the conditions have fallen into the unprofessional procedures imposed upon them by the ignorant officials having the work in charge.

The public is no less interested in the process of choosing an engineer than the competent engineer himself and, whether engineers desire to have their qualifications for their work passed upon by competent authority or not, the public is vitally interested in the question and is likely to wake up and demand its protection at any time.

In private business there is not the same necessity for protection from incompetence, because tenure of office is longer and knowledge of the business is more detailed, more thorough, and subject to closer checks; naturally, since the private business spends money in order to make it, and success is measured by the profits, while the business of the municipal or other public official is to spend money outright and he has no profit-measure of his success.

Occasionally some control of the competence of engineers in municipal work has incidentally come to a state body, such as the State Board of Health, through a provision of the law requiring approval of sewerage, water supply, and other engineering plans by such bodies. If the control extends only to approval or disapproval of plans it is salutary and may be exer-

cised without prejudice or favoritism, but if, as has sometimes been rumored, it extends to the statement of names of engineers whose plans will be accepted and those whose plans will not be considered, then there is room for doubt as to the competence and honesty of the controlling body. The question before the board with regard to any particular set of plans is not as to the reputation or experience of the engineer preparing them, but as to the sufficiency of the particular set of plans.

Only a small proportion of municipal work is covered by the controls named and the evidences of incompetence in other lines are quite as numerous as in those included therein. The ordinary board of county commissioners does not know how to choose a bridge or drainage or highway engineer. The ordinary city council does not know how to choose a city engineer or a consulting engineer for some particular work. When these officers are elected the same lack of knowledge prevails.

As regards highway work some states are providing that it shall be in charge of a state highway commission and engineer and that the county engineers or supervisors shall have their competence certified by the department. The supervision of municipal book-keeping and of municipal operation of public service industries is being put into the hands of state commissions, and the qualifications of local officials in these departments must shortly be tested and approved by the state department if the full benefits of state expert supervision are to be secured.

It is but one more step to fix the qualifications for all classes of engineers and technical employes of city and county. The obvious way to apply this test is to classify the offices according to duties, population, etc., provide methods of determining the qualifications of applicants for such employment, establish eligible lists from the results of these determinations, and provide that every employe of the city in these departments shall go through the necessary steps to get his name upon the list.

Engineering schools usually report the lack of interest in the courses treating more particularly of municipal engineering subjects, because of the present low standing of that branch of engineering work. This is due to the lack of consideration of engineering knowledge and experience in making appointments, the brief tenure of office, the low salaries, the unprofessional, not to call it ungentlemanly, treatment of the engineer by too many city councils and mayors.

Could this branch of the profession be brought up by a legislative demand for competence, enforced through a state board of high technical and business qualifications, the other disadvantages under which it labors would probably disappear in the natural course of events.

This is not a control of the engineering profession at large, such as so many engineers object to, but is a natural protection of the governmental organizations of the state against incompetence in technical employes, which, in the very nature of their method of selection the governing bodies of city, county or state are not able to determine satisfactorily. It has nothing to do with the ethics of the engineering profession, in the lines in which there is any such development, and makes no effort to reform the profession voluntarily or involuntarily. It is simply a matter of self-protection to the public.

THE QUESTION DEPARTMENT

Cost of Filter and Standpipe.

We are thinking of submitting the proposition of erecting a standpipe and filter for our waterworks at our spring election. We are a city of about 5,000 inhabitants, have now over 400 consumers and still growing. Will you kindly inform me the cost of such a standpipe and filter suitable for a city of our size?

L. R. S., Olathe, Kan.

Only the most general sort of estimate can be made in absence of detailed information as to local conditions and the use to be made of the standpipe or elevated tank. The latter may be the more economical in many cases. The cost of the standpipe for the city named should not exceed $5,000, unless there are some special circumstances increasing it, and a competent engineer may so design the plant as to reduce this cost materially. A mechanical filter plant should not cost more than $2,000, and may cost much less.

Pumps and Well Machinery for Water Supply.

We are contemplating sinking additional wells for our public water supply, and would appreciate any information that you could give us in regard to pumping machinery, methods of sinking wells, etc. A. C. G., Hillsboro, Ore.

The best treatments of these subjects will be found in Turneaure and Russell's "Public Water Supplies" ($5) and Goodell's "Waterworks for Small Cities and Towns" ($3), the latter book being about twelve years old and the former having new editions frequently, the latest scarcely two years since. This department will be pleased to give information in answer to specific questions and would also refer the inquirer to the engineers and contractors whose names will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Civil Engineers," "Consulting Engineers," "Contractors," etc.

Articles on Water Tight Joints for Vitrified Pipe.

Can you refer me to any of your back numbers now available that contain information on the construction of water-tight joints for vitrified pipe operating underheads. The case with which I am dealing is a series of 12-inch inverted siphons, operating under heads from 6 feet to 21 feet on a water supply line. While I feel that the matter is solved, I shall be pleased to know the experience in similar matters elsewhere. If the back numbers are available, kindly inform me as to the price of the same.

C. R. B., Lamar, Col.

In vol. xxxi, p. 182, is a brief article on "Concrete Water Pipes," in which the statement is made that such pipes had been tested to 40 pounds internal pressure of water, with some leakage, which did not appear at the joints.

In vol. xxx, p. 35, is an article on "Asphalt Pipe Joints," but the pipes were sewer pipes, and no information is given about the tightness of the joints under head.

In vol. xxix, p. 403, is an article on "The Use of Vitrified Tile Sewers as House Drains," in which some experiments are reported, which describe the method of making joints which stood 30 pounds' internal water pressure without leakage.

In vol. xxvii, p. 357, is an article on "The Use of Sulphur for Sewer Pipe Joints in Wet Trenches," which does not give any information about their resistance to internal water pressure.

In vol. xv, p. 90, is an article on "Sewer Pipe Joints in England," some of which were tested to 28 pounds per square inch internal water pressure before signs of leakage appeared.

In vol. xx, p. 76, is a brief statement of some advantages of vitrified pipe for water conduit lines, and on page 89 is an illustrated article on "Vitrified Pipe Conduit, Hartford Waterworks," in which it is stated that a part of the pipe is under a head of 9.65 feet of water and the method of making the water-tight cement joints is fully described. On page 151 is a brief discussion of the subject, concluding that the maximum pressure in vitrified pipe lines seldom exceeds 5 pounds per square inch. On page 355 is a statement regarding the Little Falls vitrified pipe conduit, that it was seriously injured by being subjected to a head for some days for which it had probably not been designed or constructed.

The numbers referred to can be supplied at 25 cents each, except vol. xxx, p. 35, and vol. xx, pp. 151 and 355.

Economy and Strength of Boilers.

Our borough is about to purchase a new 125 horse-power boiler with which to operate its pumping plant, and a street lighting system. The question of economy of the different types of boiler is being discussed, and I would like to have you give me any information you have immediately at hand in regard to the difference in economy between the "standard horizontal return flue brick set boiler" and an "internal furnace, tubular boiler" with brick backs (90 inches by 12 feet 6 inches); also on the internal furnace boiler, what is the best practice as to riveting girth

seams, should it be single or double riveted, and why?

J. A. B., City Attorney, ———, Pa.

The first question should be put to a mechanical engineer, who is given an opportunity to inspect the drawings and designs for the boilers and installations of boilers of similar design, or is familiar with boilers of the designs proposed. The economy of a boiler depends on so many elements of design and construction of both boiler and furnace, as well as conditions of operation, that no definite answer could be given without the detailed knowledge referred to.

If the circumferential joints of a boiler are single riveted, the longitudinal joints should be double riveted, the tension being twice as great on the latter joints.

Will our readers give their experience in regard to the first question, including full details of boiler, furnace and method of operation?

Cost and Efficiency of Electric Power.

1. What is the average cost of an electrical horse power per year of, say, 3,000 or 4,000 hours?

2. What is a fair average estimate of efficiency of the eelctric motor in delivering from prime mover?

3. In calculating electrical horse power, is the 746 watts used for one second or one minute of time. as for the steam engine?

Please explain these matters, if I am not intruding too much upon your valuable time in asking that much of you.

E. B. D., ———, Ind.

1. The cost of supplying electricity varies according to conditions. In a table published in Suplee's "Mechanical Engineers' Reference Book" ($5), the cost of electric power varies from 0.4 cent to 7.5 cents per kilowatt-hour. For lighting in a small works, subject to varying load, perhaps 3.6 per kilowatt hour would be a reasonable figure. As a horse-power is 0.746 of a kilowatt, the cost per horse-power for a year of 3,000 hours would be $80, and for 4,000 hours, $107.

2. The efficiency of dynamos varies from 70 to 96 per cent. Probably the commercial efficiency when the plant is running near full capacity will be somewhere near 90 per cent, but it will be less as the load on the machine diminishes.

3. An erg is approximately the work done when a milligram is raised one centimeter. A watt is equal to 10,000,000 ergs of work done per second. In the same units, a horse-power is equal to 7,460,000,000 ergs per second. It follows that 746 watts equal one horse-power, or a horse-power equals 0.746 kilowatt. Likewise, a horse-power hour equals 0.746 of a kilowatt hour. Each unit expresses a rate of doing work and the ratio of the rates for the same work performed is the constant given. In Foster's "Electrical Engineers' Pocket Book" ($5) is a table of equivalent values of electrical and mechanical units, which states that a kilowatt equals 44,240 foot-pounds per minute, and a horse-power equals 33,000 foot-pounds per minute, or 0.746 kilowatt. Such mechanical engineers' and architects' pocket books as Supplee's and Kidder's make serious errors in some of their definitions of electrical units and equally erroneous statements of the relations of the various units.

Photometer for Testing Electric Street Lamps.

Will you kindly inform me where I can find out if there is a way of measuring or testing the candle power of arc and incandescent electric lights while the lights are working? We wish to see if we are getting our full candle power, and will esteem it a great favor if you will give us the information.

L. R. S., ———, Kan.

Descriptions and illustrations of various photometers, luminometers, illuminometers, etc., all being apparatus for measuring the comparative intensity of illumination, will be found in MUNICIPAL ENGINEERING, vol. xxiii, p. 106, and vol. xxvi, pp. 257 and 323. They are sold by some of the dealers in engineering instruments, whose names will be found in the "Business Directory," published in each number of MUNICIPAL ENGINEERING under the heading, "Engineering Instruments," particularly W. & L. E. Gurley, Troy, N. Y. They are also sold by the dealers in electrical apparatus, such as the General Electric Co., the Electric Motor and Equipment Co., etc.

Machines for Briquetting Fuel.

Can you give us any information in regard to machines for briquetting coal or coke, or can you refer us to any one who makes machinery of this kind?

W. W. B., Dubuque, Ia.

The following firms manufacture fuel briquetting machines; Commercial Artificial Fuel Co., Toledo, O.; Mashek Engineering Co., 141 Broadway, New York; National Fuel Briquette Machine Co., 90 West street, New York; Traylor Engineering Co., Allentown, Pa.; United States Peat Fuel Co., Ft. Dearborn Bldg., Chicago; U. S. Rapid-Fire Gun and Power Co., Derby, Conn.

Pump for Small Quantities of Sewage.

It is proposed to pump sewage amounting to 8,000 gallons per day, present flow, a vertical height of 125 feet (allowing for friction in pipe for a horizontal distance of 3,000 feet). We would like to find the most economical pump to install and the proper size for the receiving well, allowing for an ultimate flow of 25,000 gallons per day. It is intended that this sewage be pumped into an 8-inch tile pipe, which is part of an old system already constructed.

We would also like something as to methods of continuous pumping, so that this 8-inch pipe would not be taxed beyond its capacity.

W. C. & S., ———, N. Y.

An 8-inch tile pipe laid on a minimum gradient of 1 in 400 will carry about 250 gallons a minute, running full, at a velocity of about 1.5 feet a second. The

sewer as laid will probably carry more than this amount, but it has to carry also the sewage coming into it along its course. The pump capacity should not exceed the capacity remaining in the receiver pipe to carry the pumped sewage. According to standard methods of design as developed in books on sewage, the capacity of the pump may therefore be limited to about 125 gallons a minute. This is probably about five times the maximum rate at which the sewage will come to the pump when the system is developed to the capacity of 25,000 gallons a day.

A rotary pump, self-priming, would be recommended by many, using electric power if possible, and automatic devices for starting and stopping the pump, letting the pump work intermittently, the length of pumping period depending upon the size of the receiving well.

It would not be difficult to design a well for the full capacity of the system which could fill up during a certain number of hours and then operate the pump by electricity, steam, gas or gasoline during certain hours of the day, the assumptions being of the total flow during the day and night, the maximum flow at certain hours of the day, and the pump capacity (say 125 gallons a minute), and the quantity to be worked out being the size of the receiving well. The number of hours of operation of the pump would depend on the amount of sewage coming to it. The pumping might be done at night and then greater capacity of pump could be used because the high level sewer would not run so full at night. The receiving well would be larger, however, on account of the larger flow of sewage in the day time.

Careful screening, ample opportunity for cleaning receiving well, pump and pipes, with all the necessary gates and waste ways, must be provided.

The intermittent system would probably be more satisfying than any attempt at continuous pumping.

Have our readers any suggestions to offer?

Day's Work on Trench.

I would ask that you tell me what, in your opinion, or from such information you have pertinent to the matter, would be the average daily work, in cubic yards, for a man digging a trench, two to three feet wide and nine feet deep, in hard, stiff material, requiring use of pick to dislodge it before material can be shoveled.

M., Paterson, N. J.

In vol. xxi, p. 406, of MUNICIPAL ENGINEERING is an article on the "Estimation of the Cost of Sewer Construction," which goes into detail regarding all the items of cost. One paragraph reads as follows:

"In good work an average one day's work of ten hours will be required to excavate and refill, carefully tamping, a trench in common earth 8 feet deep and 15 feet in length for 6-inch pipe service; 12 feet for 8-inch; 11 feet for 10-inch; 10 feet for 12-inch; 8 feet for 15-inch; 7.5 feet for 18-inch; 6 feet for 24-inch; 4.5 feet for 36-inch pipe sewers, if done under strict supervision, while, if left without inspection except his own morals to guide him, the contractor can have about 20 per cent more work done in the same time." The widths of trenches at bottom are 6 inches more than the outer diameters of the bells, with side slopes of 1 in 20, and the tamping is done in 6-inch layers.

In vol xviii is a table giving "Cost of Laying Vitrified Pipe Sewers at Various Depths," for computing which an average day's work of a man is assumed at 11 cubic yards in such trench work. In this case, also, the material is excavated and refilled, and apparently the same capacity per man is assumed for both trenching and back filling.

From McCullough's "Engineering Work in Towns and Small Cities" is a table from which a rate of about 8 cubic yards can be deduced as a day's work, digging trench. He states that a day's work back filling is about 10 cubic yards, with pick and shovel. Tough clay would reduce the day's work about one-third, and this will apply to all the figures preceding.

At Corning, N. Y., in a water pipe trench 5 feet deep in loamy sand and gravel, one man excavated 6 cubic yards in 10 hours as the average of the work. At Rochester, N. Y., one man excavated 8 cubic yards a day, and back filled 16 cubic yards a day in similar material. Hard clay would again reduce the output per man by about one-third. A depth of 9 feet would also increase the cost somewhat.

From the above figures and assumptions it may be concluded that one man may be expected to average from 5 to 6 cubic yards a day, with the probabilities in favor of the lower figure in hard, stiff material. To attain this average, his rate while actually shoveling must be materially greater.

Will our readers report their experience in this line? Contributions to our knowledge of the details of this subject are very much needed.

Garbage Disposal for Small City.

We are in want of some information in regard to methods of and plant for destruction of garbage. We have now only about 3 or 4 tons per day of wet and dry to dispose of, but the city is growing. We are hauling garbage about one mile from the city and dumping it, with our own carts and wagons. The garbage ground produces more flies than the entire city.

B. G. Fox, M. D., Health Officer,
Globe, Ariz.

Morse's "Collection and Disposal of Municipal Waste" ($5) gives the fullest treatment of the subject of garbage disposal. It has been somewhat difficult to burn the smaller quantities of garbage collected in small cities, but Mr. Morse has descriptions and brief references to several small plants, even small enough

to be portable. And there is a new one, which has a test of a couple of years, but has been put on the market too recently to get into even Mr. Morse's new book. This is the Thempson crematory, which is built by the Weber-Duller Co., of 329 Commercial Bank Building, Houston, Texas, and 660 Pacific Electric Building, Los Angeles, Cal. Some description of the furnace will be found in the January number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 63.

How to Procure Good Bridge Plans.

If I may do so without imposing upon your courtesy, I wish to again make use of your Question Department. And I take this opportunity to express my appreciation of the valuable information which I have received from MUNICIPAL ENGINEERING heretofore when making similar inquiries.

We have a bridge which is old and unsafe, and should be renewed. Whether the work will be done in the near future or not is a different question, and not for me to decide. But I wish some information as to the best method of handling the matter when it does come up. Before my appointment as city engineer the city advertised once for bids, the bidders to furnish plans and specifications. This, of course, was not very satisfactory, as each bidder was bidding on a separate set of plans, and there was practically no competition. The old bridge is a swing bridge about 140 feet long, carrying double street car line and driveway, walks, etc.; is on our principal street, and crosses Black River, which is navigable at this point. It is too light for modern conditions, having been built twenty-six years ago, and has deteriorated a good deal from rust.

I am not a bridge engineer, and could not undertake to prepare detailed plans and specifications for a bridge of this kind, and would not have time to do it in connection with my other duties, anyway. Under such circumstances, what would you consider the best method of procedure: To hire some well-known and capable bridge engineer or engineering company to prepare detailed plans, specifications, estimates, etc., the city council to first determine the general dimensions, approximate amount of money to be expended, etc.; or would it be possible and practical to advertise for bids for furnishing such plans, specifications, etc.? And what is the usual charge for such work, including inspection of work, based upon percentage of cost of structure? City Engineer, ———, Mich.

The method of advertising for bids on a bridge, plans to be furnished by the bidder, is a bad one, because it really does not give a fair basis for competition. It requires a competent consulting engineer to insure that the accepted plan is either safe or economical. To the engineer it is objectionable because it takes the technical work out of his hands and puts the decision of the engineering merits of structures in the hands of men technically ignorant, unless, as is very seldom the case, the consulting engineer referred to is employed to pass upon designs and bids.

The method of calling for plans from engineers in a competition is objectionable for the same reasons, and the consulting engineer is absolutely necessary if the best and most economical design is to be secured. Men of all grades of intelligence and training will present plans and the least competent man will most probably offer his plans at the lowest price. The differences in price will be considerable, and the low prices will be attractive to a council committee who probably will not know that money saved in procuring plans may be lost several times over from the errors or extravagances of an incompetent designer. An architectural competition is based upon a different principle, for in such a case the competitors present simply sketches showing the general features of their designs, and the successful competitor is given the work of preparing the detailed plans and specifications, and the fee is fixed, so that it is not an item in the competition.

If the structure is an engineering structure only, probably the best results will be obtained if a competent designing engineer is employed to prepare the plans. He can be selected with the aid of the city engineer and others knowing where to find experts in this line, as readily as the consulting engineer, who is necessary for good results in the other two cases, and his fees would not be greater than those of the competent contestants in the competition, so that this method will save money to the extent of the consulting engineer's fee, as well as secure a satisfactory result.

If architectural or peculiar engineering features are involved, it would seem that a competition similar to an architectural competition might be held, sketches of the archtectural structure and of the methods of solving the engineering problems being presented, and the successful competitor being given the contract for preparing the detailed plans and superintending the construction.

In this sort of engineering competition the fee for preparing the plans should be fixed beforehand, just as it is in an architectural competition. One of the principal objections to engineering competitions as ordinarily conducted would thus be eliminated. Unfortunately, engineers are not united upon the question of compensation for their professional services, as are architects, so that the city officials must fix the fees for the work without help from any official action of any body of engineers of national prominence. It is customary among engineers, and also among architects, notwithstanding the fixed schedule of the American Institute of Architects, to make reductions in percentage charges as the total cost of the work increases. Thus, according to one formulated schedule, the whole fee for work costing less than $5,000 would be 10 per cent, of which one-half would be charged for the detailed plans and specifications, while for work costing $50,000 to $100,000 the corresponding per-

centage would be 5 and 2½. These are reasonable fees for first-class service.

It will be possible, under the expert guidance of the engineer thus selected for his ability and honesty, to provide for the proper consideration of the patented features and entire structures which sometimes are demanded by the economic and engineering features of the problem. He will also supervise the preparation of the shop details, which are best left to the draftsmen of the plant securing the contract, since the methods of the different companies differ so much that one can do this work according to its own methods much more economically than if it must follow those of some other designer. The sufficiency and adaptability of these details must, of course, be satisfactory to the original designer or consulting engineer.

That the function of the consulting engineer is unknown to many city officials is shown by a recent occurrence. A certain small city had two sets of plans for a sewer system which it had paid for some ten and fifteen years ago, but had never constructed the sewers. Instead of employing the original designer or other competent engineers to bring their plans down to date, or employing a consulting engineer to advise them as to the proper mode of procedure or as to the sufficiency of the existing plans and the possibility of extending them to fit the enlarged city, the city officials, in their ignorance of the most economical procedure for the city, as well as of the correct line of action from a professional point of view, advertised for engineers to appear in person at the city hall on a certain date and make propositions for preparing plans. The mayor, being a physician, it might have been assumed that professional ethics would have some consideration, but his ignorance of the engineering profession was so dense that he called the designers of sewer systems architects.

This procedure is not surprising, for it is not new, but there responded to the invitation to give time and money to the city with small hope of return some ten or twelve engineers, ranging from those of highest standing down, and all but three were willing to enter into a competition in which price for the service was as much a part of the competition as the relative standing of the engineers.

The lottery in this case happened to bring a good result for the city, and this will encourage other cities to follow the same course of procedure. For the chance in this lottery, each engineer entering the competition was willing to throw away his professional character and enter the race on a business basis solely. The result is an irretrievable injury to the profession at large, as well as to every engineer engaged in the contest. Such competitions have been engaged in by competent engineers before, but not with such an array of high-grade talent, and the results have seldom been so satisfactory, for price has usually had more influence than in the present case.

MUNICIPAL ENGINEERING has done its full share of preaching on the subject of professional ethics, and is ready to acknowledge the futility of its efforts in this direction when the scramble for employment leads so many of those, concerning whose technical ability there can be no question, to abandon the profession to its fate and reduce it even below the grade of the average bridge letting, which has at least a financial standing due to the great manufacturing plants owned or represented by the bidders.

The recommendations made at the beginning stand, however, as professional standards recommended by engineers not yet surrendered wholly to the commercial spirit, which may occasionally be attained when a city happens to have an engineer with some sense of professional propriety in whom it has enough confidence to follow his recommendations.

Books on Asphalt Construction.

I am employed by an asphalt company as foreman and have been for the past few years. As I am following this line of business, I would like to purchase some books that would be of benefit to me.

R. L., Chicago, Ill.

Richardson's "The Modern Asphalt Pavement" ($3) contains the fullest technical discussion of the manufacture of asphalt pavements and their properties. It is particularly authoritative regarding Trinidad asphalts and their use.

Peckham's "Solid Bitumens" ($5) is the latest book, and covers all classes of solid bitumens, but with particular reference to those that can be used in asphalt pavements.

Tillson's "Pavements and Paving Materials" ($5), Baker's "Roads and Pavements" ($5) and Byrne's "Highway Construction" ($5) have excellent chapters on asphalt pavements and their comparisons with other kinds of work.

Asphalt Chemists.

Please give me the names of leading asphalt paving experts and chemists in Chicago. I have heard some one quoted frequently as having a great reputation for successfully using California asphalt in paving mixtures.

B., ———, Pa.

The chemist in charge of the Chicago municipal asphalt laboratory is L. Kirschbraun. He has had much experience in the use of California and other asphalts in pavements in Omaha and Chicago, in particular, and may be the one referred to. Isaac Van Trump is the head of the Chicago branch of the New York testing laboratory of Clifford Richardson, which seems to make a special of Trinidad asphalt, but is experienced in all kinds.

The Chicago manufacturers of asphalt mixtures and pavements have practical and technical experts in charge of their

work. Their names will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the various "Asphalt" headings.

Dealers in Rock Asphalt.

Will you kindly give me list of names of firms handling rock asphalt, and very greatly oblige?

E. R. W., ———, Mich.

Foreign rock asphalts are handled by the Sicilian Asphalt Paving Co., 41 Park Row, New York city, and Gabriel & Schall, 205 Pearl street, New York city. American rock asphalts are handled by the Downard-Lester Co., Ardmore, Okla., and the Wadsworth Stone and Paving Co., Pittsburg, Pa.

Forms for Daily Force and Material Reports.

We have a population of 10,000. I want a daily street foreman's report that is simple and easily kept by an uneducated foreman and yet one that is comprehensive.

I enclose outlines that I have made out, but they don't just suit me. The quarry report fails to tell how far per hour the wagons travel. I have never seen just what, and don't know exactly what, I want, but it is more than likely you have on file just the thing I am looking for.

I want weekly and monthly reports deduced from the daily. Want them all in pads and also in book form for the office. S. H. R., Winchester, Ky.

The forms referred to are as follows:

DAILY REPORT OF STREET FOREMAN.

Headings of Columns—
- Col. 1—Laborers.
- Col. 2—Rate per hour.
- Col. 3—Cleaning Ditches, hours.
- Col. 4—Flushing Gutters, hours.
- Col. 5—Flushing Sewers, hours.
- Col. 6—Filling Ruts, hours.
- Col. 7—Cutting Weeds, hours.
- Col. 8—Spreading Macadam, hours.
- Col. 9—Rolling Macadam, hours.
- Col. 10—Oiling Streets, hours.
- Col. 11—Building Culverts, hours.
- Col. 12—Scraping Streets, hours.
- Col. 13—Repairing and Cleaning Culverts, hours.
- Col. 14—Building Bridges, hours.
- Col. 15—Repairing Bridges, hours.
- Cols. 16 to 22—Materials Used:
  - 16—Cement, Bags.
  - 17—Sand, Bushels.
  - 18—Stone, Loads.
  - 19—Dirt, Loads.
  - 20—*Tile, Lin. Feet.
  - 21—Lumber, Feet.
  - 22—Brick.
- Col. 23—Making Crossings.
- Col. 24—Street.
- Col. 25—Remarks.

*Sizes from 4 to 36 inches are specified in column.

DAILY REPORT FOR THE SOUTH PARK QUARRY.

Headings of Columns—
- Col. 1—Laborers.
- Col. 2—Rate per hour.
- Cols. 3 and 4—Stripping:
  - 3—Shoveling, hours.
  - 4—Picking, hours.
- Cols. 5 to 9—Quarrying:
  - 5—Bar, Pick and Shoveling, hours.
  - 6—Drilling, hours.
  - 7—Depth in Feet.
  - 8—No. of Power.
  - 9—Sticks of Dynamite.
- Col. 10—Feeding Crusher, hours.
- Col. 11—Engine Men, hours.
- Col. 12—Dump Men, hours.
- Cols. 13 to 15—Loads at Quarry:
  - 13—Rock.
  - 14—Spalls.
  - 15—Dirt.
- Cols. 16 to 18—Loads to City:
  - 16—Rock.
  - 17—Spalls.
  - 18—Dirt.
- Col. 1—Teams.
- Col. 2—Rate.
- Col. 3—Hours.
- Col. 4—No. of Loads to Dump.
- Col. 5—No. of Loads to Crusher.
- Col. 6—No. of Loads to City.

The above forms seem to be sufficiently detailed for all ordinary purposes, perhaps more so than the ordinary "uneducated foreman" will be able to handle. The report of material used is presumably not divisible among the various laborers whose names appear in the first column of the first blank, and for that reason, as well as because all the items can be arranged in a single column down the left hand side of a narrow page, with one other column for the amounts used to be entered, it would be easier for the "uneducated foreman" to have the report of material used on a separate sheet or on the back of the report of labor.

The quarry report might be improved likewise by putting all the reports of labor together, and putting the measurement of work done and materials used and product in a separate table, either on the same page or on the back of the sheet or on a separate sheet, as is most convenient. If a column is added to the report of teams, giving room for statements of place from which load is taken, then the clerk who compiles the reports can compute the distance each load is hauled and the total for the day.

Forms in use by others will be found in MUNICIPAL ENGINEERING, vol. xxx, p. 409, in an article on "Loose Leaf System for Field Notes and Office Records," also in vol. xxxvi, p. 1, in an article on "Cost Keeping on Municipal Contract Work." While the forms given in these articles will not suit our correspondent's needs exactly, he can get some help from the principles developed. Copies of these numbers can be supplied at 25 cents each.

Our readers are invited to send for publication forms for reports of such work which they have found convenient, both daily or weekly reports and weekly, monthly or annual summaries of the daily or weekly reports.

Information About Motor Driven Railway Cars.

I shall be interested to learn of any literature pertaining to the use of gasoline engines in the propulsion of cars for urban and interurban use. Any information on this subject will be appreciated.

A. W. K., Harvey, Ill.

W. R. McKeen, Jr., of Omaha, Neb., is probably as good authority on this sub-

ject as any. He will doubtless supply any desired literature. He has a good general discussion of the subject in the Proceedings of the New York Railroad Club for April 19, 1907.

W. F. Magruder has a paper on gas engines in railway work in the proceedings of the Central Railway Club for Jan. 8, 1904.

Philip Dawson has an article on the use of independent motor cars on railways in the Street Railway Journal for Nov. 6, 1904.

The Union Pacific motors are described in the Railway Age, March 10; the Automobile, April 1; the Railway Master Mechanic, August; Scientific American, Aug. 26; Railway and Engineering Review, Oct. 7, all in 1905.

Ordinance Controlling abatement of Nuisances and Assessing Cost.

Can you send me copy of ordinance providing for the abating of nuisances by the city and assessing of special tax bills against the property for the expense of such work. I refer particularly to filling stagnant ponds, removing dirt, snow and other obstructions on sidewalks.

S. W. H., Clayton, Mo.

In some States the Board of Health has charge of such work, in others the council or Board of Public Works, and in others the one or the other, according to the nature of the nuisance.

The following paragraphs from the ordinances of an Ohio city seem to cover the desired points, but the differences in State laws must be considered and modifications must be made in accordance therewith:

1. As to nuisances on private property:

All cellars, lots and parcels of land in the city, upon or in which pools of stagnant water may stand or collect, or which may be moist or wet, by means of defective drainage or otherwise, shall be drained or sewered by the person owning, controlling or occupying such cellar, lot or parcel of land, or in default thereof, after due notice so to do by the chief of police or health officer, the same may be sewered or drained by the city at the expense of such owner, controller or occupant.

Owner, occupant, lessee or other person having control of such premises, in addition to the penalty provided in this subdivision, shall be liable to said city for the cost of such abatement or removal, to be recovered in a civil action before any justice of the peace in the city, or other court having jurisdiction thereof.

2. As to cleaning sidewalks:

Every owner, occupant or person having charge of any tenement, building, lot or land fronting on any avenue, street, alley or other public highway of the city shall clear the whole sidewalk in front of said tenement, building, lot or land, of snow and ice before 9 o'clock of the forenoon of each day; provided, that if the sidewalk in front of said tenement, building, lot or land is not flagged or paved, a pathway thereon shall be cleared of ice and snow to the width of at least five feet; and if from any cause it shall be impossible to remove all the snow and ice which may adhere to such sidewalk, then every such owner, occupant or person having charge shall cover such snow or ice as shall so remain with such coating of ashes, sand or other substance as may be necessary to render travel safe and convenient. Every owner, occupant or person having charge of any tenement, building, lot or land fronting upon any avenue, street, alley or other public highway of the city shall keep the entire width of said sidewalk, from curb to lot line, free and clear of all earth, sand, brick, stone, rubbish, dead trees and dead branches of trees or other material which from any cause whatever shall have accumulated or may accumulate upon said sidewalk above the established grade of the same, and shall also cut and remove from the sidewalk between the lot and curb line all weeds, grass and vegetable growths that are more than four inches in height. If the owner of any building, lot or land fails to comply with the provisions of this ordinance, then the Board of Public Service may remove the snow, ice, earth, sand, brick, stone, rubbish, dead trees or other materials, weeds, grass and vegetable growths from the sidewalk in front of the premises of such owner, and may charge the expense thereof to such owner, and if upon being notified, he fails to pay the city the amount of such expense, then said amount may be certified by the proper city officer to the county auditor, and the same shall act as a lien upon the property of such owner, and shall be collected as provided for in the case of special assessments.

The ordinance in a Michigan city provides that if the owner fails to remove the obstructions the Board of Public Works removes them and collects the cost in the same way that assessments for sidewalk repairs are collected.

The above ordinances are rather cumbersome in form and could be improved in that regard at the same time that they are being changed to suit the laws in Missouri.

Dangerous Building Within Fire Limits.

I want information concerning restriction and removal of dangerous buildings within fire limits.

M. S. M., Madison, Neb.

Ordinances in Cincinnati, O., and Dubuque, Ia., are quote in MUNICIPAL ENGINEERING, vol. xxxvii, p. 184, and additional information is there given about the methods in Indianapolis, Baltimore, Cleveland, St. Louis, San Francisco, Chicago, Detroit, New Orleans, Toronto, Wisconsin cities, and Washington, D. C.

The city of Atlanta, Ga., provides that "whenever any frame building within the fire limits shall have become damaged by fire or decay, the extent of which, in the judgment of the inspector of buildings, exceeds 50 per cent of the value of such building, it shall be condemned by the inspector of buildings, and it shall be unlawful to repair the same." Provision is made for appeal to the chief of the fire department and the city engineer if the property owner is not satisfied with the decision of the building inspector.

Other sections provide that "every building which shall appear to the inspector to be especially dangerous in case of

fire, by reason of bad condition of walls, overloaded floors, defective construction, decay or other causes, shall be held to be unsafe; and the inspector shall notify the owner to cause the same to be made safe and secure or taken down; and when public safety requires immediate action, the inspector may enter upon the premises, with such assistants as may be necessary, and cause the said structure to be secured or taken down without delay, at the expense of such owner or party interested. The inspector "shall also affix a notice of the dangerous character of the structure to a conspicuous place on the exterior wall of said building; any person removing such notice so affixed, shall be liable to a fine of not less than $10, nor more than $50 for each and every offense, to be paid into the treasury of said city. The owner or party having an interest in the unsafe building or structure, being notified thereof in writing by the inspector, shall forfeit and pay a fine to the use of said city for every day's continuance thereof after such notice, a sum of not less than $10 nor more than $50.

Another section names the trades which shall not be carried on in buildings within the fire limits, and the conditions under which, only, some can be carried on.

The general penalty of not more than $100 is fixed for the violation of any section of the building ordinance.

These provisons seem to cover all parts of the question as completely as any ordinance with which the writer is acquainted.

City's Right to Remove Public Nuisance.

The case of Nerio v. Maestretti (Cal.), 98 P. 860 was cited in the legal department of the MUNICIPAL ENGINEERING Magazine in deciding that "the continued occupation by one of a portion of a public street by maintaining a house thereon is a continuance of a nuisance created by the obstruction which under civil code Sec 3490 can not by lapse of time be legalized, and the public officers charged with removing obstructions from streets may remove the same on the refusal of the owner to do so." Please give me the reasons assigned by the court in the determination of this case.

SUBSCRIBER, ———, Ohio.

In this case plaintiffs had erected houses upon a part of a public street of the city and county of San Francisco. The board of works had given notice to the plaintiffs to remove these structures and abate the nuisance created by them. Upon plaintiffs' failure and refusal to do so they entered and proceeded to remove the obstructions. Plaintiffs' action was to enjoin the board of works from alleged unlawful interference with their property.

The court said that "under the laws of the state of California the board of works was charged with the duty of removing obstructions from the public streets of the city and county," and that the appeal was entirely without merit. No further reasons were assigned, but an examination of the Civil Code of California shows that the decision is wholly statutory. Section 3479, in defining a nuisance, includes any "obstruction to the free passage or use of property, so as to * * * unlawfully obstruct the free passage or use, in the customary manner of any navigable lake, or river, bay, stream, canal or basin, or any park, square, street or highway."

The court's opinion that it was the duty of the board of public works to abate the nuisance is undoubtedly based upon section 3494 which, says: "A public nuisance may be abated by any public body or officer authorized thereto by law." The board of public works would have jurisdiction over the streets in the exercise of their powers and duties under the California statutes.

The court's opinion that a nuisance could not be legalized by a continuous occupation was based upon section 3490, which says: "No lapse of time can legalize a public nuisance, amounting to an actual obstruction of a public right."

Simple Tests of Cement.

Will you be kind enough to inform me of some simple formula for testing cement without a chemical analysis being made?

J. F. NOLL, Harrisonburg, Va.

A chemical examination is seldom necessary for testing cement. No one who is not prepared for full testing and examination of cement or for paying an established laboratory for that work should attempt to use a cement which has not yet proved its quality. Every one should make at least the rough tests for the condition of the cement delivered, no matter what the excellence of the reputation of the cement may be. There are accidents which may happen to the cement on the way from the factory, substitutions and mixtures which can be detected by some of the short tests and which may be injurious to the work if they are not detected in time.

Such tests, as well as the standard detailed tests and examinations are given in the Hand Book for Cement Users ($3). They will also be found in the following numbers of MUNICIPAL ENGINEERING and others: Vol. xxxiv, p. 233; xxxiii, p. 415; xxviii, p. 458. These numbers can be supplied for 25 cents each.

Material for City Beautiful Campaign.

Will you send me literature or any information you may have relative to the "beauty campaign" carried on in Dayton, O., by the National Cash Register Company?

Any descriptions of what was accomplished there in improving the yards, gardens and general appearance of the city, or any account of similar work done elsewhere, will be greatly appreciated.

E. V. P., Spokane, Wash.

The National Cash Register Company has published much material of this sort

some of which can doubtless be obtained upon application to its office in Dayton, O., together with references to many magazine articles concerning its work.

Reference should be made to the standard indexes to periodical literature, such as Poole's Index, which can be consulted at almost any public library, for names and dates of articles upon the work done in other places.

There are many special publications by city organizations and by architects, showing what has been planned by the cities. Charles Mulford Robinson, Rochester, N. Y., and John Nolen, Cambridge, Mass., are two who have prepared the largest numbers of such reports. Doubtless some of them can be obtained from them by correspondence.

Among Mr. Robinson's reports are those on San Jose, Oakland, and Los Angeles, Cal.; Denver, Col.; Cedar Rapids, Iowa; Ft. Wayne, Ind., and Ridgewood, N. J.

Mr. Nolen has reported upon San Diego, Cal.; Reading, Pa., and several others.

Kelsey and Guild of Boston, Mass., have reported on Greenville and Columbia, S. C.

D. H. Burnham, Chicago, Ill., has reported alone and with others on Washington, Chicago, Cleveland, San Francisco and others.

The Civic League of St. Louis, Mo., has published a number of books and pamphlets on city plan, playgrounds, billboard advertising, the smoke nuisance, city lighting, etc.

Hartford, Conn., Municipal Art Society, New York City Art Commission, New York Municipal Art Society, American Civic Association, with headquarters in Washington, D. C.; the National Municipal League, North American Building, Philadelphia, Pa., are organizations with publications upon all phases of the question of making the city beautiful.

Philadelphia, Pittsburg, Indianapolis, Memphis, St. Paul, Madison, Wis.; Spokane, Louisville, Boston, Buffalo, Montreal, Seattle, Harrisburg, Ottawa, Detroit, Baltimore, Columbus, O.; Colorado Springs, Syracuse, Kansas City, Minneapolis, Duluth, Springfield, Mass.; Ogdensburg, New Orleans, Atlantic City, Providence are other cities, large and small, which have more or less elaborate plans concerning which more or less has been published, some of them having made a good start in the construction.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Effect of Length and Irregular Profile on Suction Line of Pumps.

To the Editor of MUNICIPAL ENGINEERING:

Sir—A suggestion on "Effect of Length and Irregular Profile on Suction Line of Pump," on p. 182 of Question Department for March.

Referring to the editor's figures, which I have checked and endorse, I will offer for consideration the following further analysis: The two downward legs of the siphon aggregate not more than five feet. These being on grade sufficient to carry the required amount of water down their slope at much less than the full pipe, so soon as sufficient air is accumulated to fill the top of the down leg of pipe the water will run as a stream in the bottom, sustained by the friction of its speed, as in any stream, and the effect which was realized when the pipe was full, of this leg of pipe acting as a counterpoise against so much of the rising leg of the siphon, is lost. The total rises in the pipe, therefore, must be sustained by suction at the pump (atmospheric pressure). The rises aggregate six feet about. This added to the nine feet of frictional, etc., resistances makes a total of about fifteen feet that must be sustained at the pump. Add to this, as stated, 50 per cent increased resistance with age, or, say, five feet, we now have a total of twenty feet as the limit of resistance, which is still an easy proposition when the pump is filled with water.

As, then, these summits are safely below the possibility of forming an actual air leak and the question is to handle the accumulated air to save the pump from shock and unpriming, allow me to suggest the feasibility, and as the summits are quite distant, the probable great convenience of having some adopted form of standpipe and good suction pump in the

line at the pump house for extracting what free air may come. This would take care of not only the accumulation drawn from the summits from time to time, but also of any further air occluded during the long passage from there to the pump, and insure the pump solid water.

C. E. V., East Palestine, O.

Large Water Tanks.

In reply to the inquiry in the February number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 112, for the location of very large water tanks, the following information has been gathered:

Simpson Brothers Corporation, Boston, Mass., send data for a reinforced concrete reservoir at Waltham, Mass., Bertram Brewer, City Engineer, stating that the inside height of the reservoir is 40 feet, the diameter is 100 feet, the walls at the base are 18 inches thick and at the top 12 inches, and the capacity is over 2,000,000 gallons. It was constructed in 1908, has had no repairs and is in perfect condition.

A 9,000,000 gallon tank, 321 feet square and 16 feet deep, top 110 feet above ground, supported on 81 steel columns, is proposed for the city of Calcutta, India, but not yet built.

Large tanks supported on towers which are in successful use are the 300,000 gallon tank in Ft. Snelling, Minn., 131 feet high; the 200,000 gallon tank at Louisville, Ky., 220 feet high; the 185,000 gallon tank at Vineland, N. J., 120 feet high.

Electrically Driven Pumps for Water Works.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In regard to the feasibility of electrically driven pumps, I would say in answer to P., ———, Mich., on p. 185, of the March number, that the maximum efficiency and economy can be derived from direct connected pumping machines.

A volute pump, having synchronous motion, 25 cycle alternating current, is simple, durable and highly efficient. There are several such built in this country, foremost among which are the Allis-Chalmers and other reliable types. I have found much reliability in the Worthington pumps, built by Henry R. Worthington Company. Philadelphia, Pa. I have installed these for displacing steam pumps, with 2,200 to 4,000 volts and as low as 220 volts for effecting reduction of operating costs over that of steam systems.

WM. P. SLIFER,
Pittsburg, Pa.

CURRENT INFORMATION

Boston's Mayor Asks Help—Testing Meters—Taxing City Property—Street Railway Assessment—Foreign Cement Trade—Rapid Transit in New York—Ohio Sewage Purification—Massachusetts Municipal Reports—Police Department Methods—Sewage Disposal for New York—Highway Bridges

Boston's New Mayor to the Bureau of Municipal Research.

The new Mayor of Boston under the new charter recognizes the good work of the Bureau of Municipal Research in New York by the following letter:

As you are probably aware, the city of Boston has just entered upon its first administration under an amended city charter and a four year mayoralty term; a great deal of reorganization and readjustment seems to be necessary or advisable. I think that our city officials, as well as our citizens generally, realize the importance of making the first steps now to be taken of a sound and constructive character, to the end that the different departments and authorities of our city government may be able to co-operate harmoniously toward securing a better and more efficiently governed Boston which we are all aiming for.

As mayor of the city I should like very much to have an opportunity for a conference with one of the directors of the Bureau of Municipal Research as soon as possible, as to the experience of your Bureau in analyzing the elements of similar municipal problems in New York and other cities; I would like more especially to be fully informed as to the constructive measures and methods that are being installed and tested under the advice of your Bureau in other cities.

Would it be possible for one of your directors to come to Boston for this purpose, preferably on Tuesday, March 15th, for a conference with me, at which city officials and city books could be within easy access? I should expect to reimburse your Bureau for such charges as may be necessary for this purpose, and can assure you that Boston's officials would appreciate such co-operation as you may nd it possible to give.

In case of your acceptance of this invitation, I trust that it may be possible for your representative to devote at least

two days in Boston to conferences and explanations which I will arrange.

Proposed New Jersey Law Governing Tests of Light Meters.

A bill was introduced in the New Jersey legislature, March 7, which would give the governing body of any city in New Jersey authority to appoint an inspector or inspectors of gas and electric meters, whose duty it will be to examine, prove and ascertain the accuracy of any and all gas and electric meters used for measuring or ascertaining the quantity of illuminating or fuel gas or electricity furnished by any corporation. The bill provides that any consumer of gas or electricity may request an inspector in writing to inspect the meter, but before having this done the applicant must deposit a fee, to be uniform in each case, the amount of which shall be taxed by the governing body. If, on examination, the meter shall be found to be five or more per cent. defective or incorrect, the inspector shall order the corporation forthwith to remove the meter and place instead thereof a correct measuring device. The expense of such inspection and test shall be borne by the corporation if the meter is found defective. In case the meter is found correct, the cost of the test shall be paid by the consumer. The inspectors are required to make periodical tests to ascertain the quality of the illuminating gas and the record of the result of such test must be filed, and be open to public inspection. In the event of a public utility commission law being enacted to include work similar to that provided in this bill, the passage of the measure will not be pressed.

Bill to Tax Municipal Real Estate in Other Taxing Districts.

A bill was introduced in the New Jersey legislature, March 7, which provides that the real estate of the counties and municipalities of the state, used for the purpose of public water supply, shall be subject to taxation by the taxing district in which it is located. The bill differs from the Wright law of 1906, which was declared unconstitutional by the supreme court, in that it calls for taxation on municipal property used for water supply purposes. The Wright law would have taxed all municipal property, whether used or unused, or whatever the usage.

The Cement Trade with Foreign Countries.

The imports of foreign cements into the United States have been dropping off at a very rapid rate in the past two years. In 1907 they were 2,111,819 barrels of 380 pounds, somewhat more than for a few previous years, but in 1908 they dropped to 883,418 barrels, and in 1909 to 454,510 barrels, the lowest figure in the published history of the industry.

The decrease in imports has been most pronounced in the trade with Great Britain, from which we imported only one-twentieth as much last year as in 1907; Belgium, which is reduced to one-fifth in the three years; Germany, reduced to one-fourth. The imports from France remain steadily about 40,000 barrels a year. The imports from Canada are fifty times as much as in 1907, now amounting to about 500,000 barrels a year.

The exports of cement seem to have increased from 900,550 barrels in 1907, and 846,785 in 1908, to 1,056,922 in 1909, but when the exports to Panama are deducted as being hardly foreign trade, the exports have really diminished about 200,000 barrels in the three years, for in 1907 Panama took only 82,569 barrels, and 75,666 in 1908, while the consumption on the canal in 1909 jumped to 438,876 barrels, as shown by the custom house records. Three-fourths of the last named amount was imported in the last six months of the year.

Street Railway Must Pay Paving Assessment.

The Mississippi supreme court declared invalid, March 14, the exemption from the expense of street paving claimed by the Jackson Electric Railway Company. Justice Mayes, who handed down the opinion, holds that the aldermanic body has no right to sign away an exemption of this nature.

History of Rapid Transit in New York City.

The Public Service Commission for New York City has printed separately Appendix A of its report for 1909, giving a history and description of rapid transit routes in New York City adopted under the rapid transit act, embracing routes constructed, under construction and validated for construction, together with a map of each route and a combination map showing all such routes, also routes laid out but not validated as yet.

Sewage Purification and Stream Pollution in Ohio.

The quarterly bulletin of the Ohio State Board of Health for the last quarter of 1909 contains a preliminary report on an investigation of the condition of the Ohio river as regards pollution and its effects, made by Burgess, Kimberly & Long, consulting engineers at Columbus, O., for the Ohio River Sanitary Commission.

The conclusion reached is that the river at no point is safe and satisfactory in its raw state for drinking purposes, and that filtration only will purify it beyond question.

The bulletin also contains a report of an investigation of the efficiency of the Dayton electrolytic cell for the disinfection of water and sewage, made in the Board's laboratories. The cell is made to produce a weak solution of sodium hypochlorite for laundry purposes and the tests were made at the request of the secretary of the Board to determine whether it

would be efficient for sterilizing water and sewage. The conclusion is that it does not equal in economy the use of chloride of lime for the same purpose where it is possible to use that chemical.

Uniform Municipal Reports in Massachusetts.

The Bureau of Statistics of Massachusetts, Charles F. Gettemy, director, has issued Municipal Bulletin No. 1 in accordance with an act of the last legislature whereby the duty is imposed on him of prescribing forms or schedules for uniform annual returns, giving detailed classified receipts and payments, debts, assets and liabilities for cities and towns.

The bulletin follows the statutes which have been passed from time to time regarding the legitimate operations of municipalities, and thoroughly analyzes and classifies them, with references to act and section. With each item is given an explanation of the entries which must be made under it, so that the municipal accounting officer can find out exactly where to put every sum representing a receipt or expenditure, and just how to make the balance sheet for his corporation.

The bulletin is an excellent text book on municipal accounting, even if its forms are restricted to those in use in Massachusetts.

Sewage Disposal for New York City.

The Metropolitan Sewerage Commission of New York has published a "Digest of Data Collected Before the Year 1908," and a preliminary report, dated March 1, 1910, in which it gives a brief statement of the progress of the work, the program followed and the conditions found. It recommends an interstate commission established by the coordinate action of the legislatures of New York and New Jersey, confirmed by the U. S. Congress, which shall have control of the problems, which are now rapidly becoming serious.

The report answers the specific questions asked by the legislature, to the effect that the problem is too large for the 80 or more municipalities interested to take care of by any attempt to procure an inter-city agreement; that sedimentation, screening, filtration and sterilization and their modifications are the methods of purification most worthy of consideration; that a sewerage district of about 700 square miles, half in each state, would be required to cover all the problems of conservancy of the sanitary condition of the harbor; and that the best system of administrative control would be the interstate sewerage commission.

The recommendations are a commission of the city of New York, or the state, to which all questions of sewerage in the New York part of the district must be referred, for treatment of the New York problems until such time as the co-operation of New Jersey can be secured.

Modern Highway Bridges.

The Illinois State Highway Commission, A. N. Johnson, state engineer, has published a pamphlet on "Modern Bridges for Illinois Highways," which gives information about the work of the commission in giving free advice on formal request of county, municipal and township authorities, and instructions as to the procedure to be followed to secure this advice. The booklet also contains 26 plates of photographs, with instructions, showing poor methods of construction and the better methods which should replace them.

Police Department Methods.

The business methods of New York City's police department are the subject of a 212-page publication of the Bureau of Municipal Research, price $1. It contains a critical study and constructive suggestions pertaining to administrative and accounting methods of the Bureau of Repairs and Supplies, based upon an inquiry requested by Police Commissioner Bingham in July, 1908, and pursued from August, 1908, to April, 1909, with the co-operation of Wm. T. Baker, then first deputy and now police commissioner.

ORGANIZATIONS AND INDIVIDUALS

Government Testing Laboratory—Technical Schools—Civil Service—Standardizing Paving Specifications—Technical Meetings—Personal Notes

Government Tests of Fuels, Structural Materials and Mine Accidents.

At the regular monthly meeting of the Engineers' Society of Western Pennsylvania, Feb. 15, Elmer K. Hiles was reelected secretary for the ensuing year.

A paper on "The Government Testing Station in Pittsburg" was presented by Mr. J. C. Roberts, assistant chief engineer, Technologic Branch, U. S. Geological Survey. Lantern slides were shown, illustrating apparatus in use at the station,

and a very illuminating description of the work accomplished, as well as that to be taken up in connection with the testing of structural materials, fuels and the causes and prevention of mine accidents was given.

Up to the present time the work with structural materials has been confined to reinforced concrete and the constituent material of concrete, and to the testing of various clay products in the Clay Products Bureau.

During 1910 it is expected that a 10,000,000-pound testing machine will be installed, capable of testing 65-foot full-size section columns, etc.

In the fuel investigations, most of the coals from the various districts have been tested under boilers and in gas producers, and various liquid fuels have been investigated. Much work has been done with briquetting coals. Investigations have been made along the line of the waste of coal, the conservative estimate being made that 200,000,000 tons of coal are wasted annually by being thrown on the culm banks, or left in the mine in pillars and otherwise. The gas producer investigations have demonstrated that highly efficient results can be obtained with the roof coal, bone coal, etc., that is usually wasted. When firing the producer with washer refuse, carrying 68 per cent ash, full load has been carried on the gas engine.

Much work has been accomplished in connection with the investigations of the causes and prevention of mine accidents. The loss of 3,000 to 4,000 lives yearly in the United States indicates the importance of this work.

Explosives are tested and the station has established a list of "permissible explosives" for use in coal mines.

Safety lamps are tested under every possible circumstance of use, as well as the various types of rescue apparatus. In the rescue and training stations now in operation at Pittsburg, Urbana, Ill., Knoxville, Tenn., McAllister, Okla., and Seattle, Wash., training classes are established to educate the miners in the use of rescue apparatus, and the operators are urged to send picked men to attend these classes and to establish local rescue stations in the vicinity of their mines.

The Technical Schools.

Engineering Bulletin No. 1 of the University of Kansas, at Lawrence, contains papers on "A Ballistic Electro Dynamometer Method of Measuring Hysteresis Loss in Iron," by Martin E. Rice and Burton McCollum, and "Voltage Regulation of Alternators," by Mr. McCollum.

"A Study of Base and Bearing Plates for Columns and Beams," by N. Clifford Ricker, forms the subject of Bulletin 35 of the Engineering Experiment Station of the University of Illinois. Formulas giving the safe load for steel and cast-iron plates of the usual forms are set forth and a series of tables makes the designing of such plates a very simple matter.

"The Thermal Conductivity of Fire Clay at High Temperatures," by J. K. Clement and W. L. Egy, issued as Bulletin No. 36 of the Engineering Experiment Station, University of Illinois, is a report of the results of experiments on the thermal conductivity of several commercial fire clays at high temperatures. A detailed description of the instruments and methods of high temperature measurements is included.

The Clarkson Bulletin, Potsdam, N. Y., has the Founder's day address of Prof. I. N. Hollis on "Training Men for the Industries and the Advancement of Science," and articles on the turbine wheel, Halley's comet and the sanitary examination of water. At the Charter day exercises, March 18, Charles P. Steinmetz, of Schenectady, N. Y., delivered an address on "The Industrial Use of Luminescence."

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

April 20: Engineer in wood preservation, district No. 2, Forest Service, at $1,300 a year.

May 4: Two laboratory aids and engineers in Forest Products Laboratory, Madison, Wis., at $900 a year.

Committees of the Organization of City Officials for Standardizing Paving Specifications.

The following standing committees have been appointed to consider the subjects assigned to them and make reports at the convention to be held in New York in January, 1911. Undoubtedly they will be glad to hear from all city officials interested in the respective subjects.

Asphalt—Geo. W. Craig, chairman, Omaha; Wm. R. Benson, vice-chairman, Philadelphia; Chas. E. P. Babcock, Buffalo; Lester Kirschbraun, Chicago; George W. Tonson, Toledo.

Bituminous Concrete—Linn White, chairman, Chicago; L. W. Rundlett, vice-chairman, St. Paul; L. W. Anderson, Grand Rapids; J. P. Sherer, Milwaukee; Geo. F. McConagle, Salt Lake City.

Bonds, Guarantees and Uniform Bidding Blanks—W. J. Hardee, chairman, New Orleans; H. C. Allen, vice-chairman, Syracuse; George H. Norton, Buffalo; B. T. Goodnow, Kansas City; Charles A. V. Standish, Chicago.

Concrete—J. H. Weatherford, chairman, Memphis; Abram Swan, Jr., vice-chairman, Trenton; N. E. Murray, Chicago; L. A. Jansen, Milwaukee; Otto H. Klein, New York.

Creosoted Block—George W. Tillson, chairman, New York; Andrew Rinker, vice-chairman, Minneapolis; Albert F. Keeney, Pittsburg; N. S. Sprague, Pittsburg; J. C. Travilla, St. Louis.

Macadam—J. L. Darnell, chairman,

Kansas City; Wm. H. Brooks, vice-chairman, Philadelphia; Walter J. Leininger, Chicago; H. W. Klausman, Indianapolis.

Stone Block—B. T. Fendall, chairman, Baltimore; George S. Smith, vice-chairman, New Orleans; Morris R. Sherrerd, Newark; John Minwegen, Chicago; M. F. McKenna, Bridgeport.

Vitrified Brick—Edward H. Christ, chairman, Grand Rapids; D. M. Roberts, vice-chairman, Terre Haute; Henry Maetzel, Columbus; John B. Hittell, Chicago; W. K. Seitz, St. Joseph.

Publication—Felix A. Norden, chairman, Chicago; A. C. Kugle, vice-chairman, Omaha; C. D. Hill, Chicago; Thos. P. Wriggins, Trenton; John C. Ely, Dayton.

Technical Meetings.

The next annual convention of the National Electric Light Association will be held in St. Louis, Mo., May 23 to 28.

At the regular meeting of the Canadian Society of Civil Engineers, held in Montreal, March 17, H. B. Lordly presented a paper on "Subaqueous Concrete Work," and W. H. Breithaupt one on "Grade Separation."

The annual convention of the American Water Works Association will be held at New Orleans, La., April 26, 27, 28, 29 and 30. J. M. Diven, secretary, 14 George street, Charleston, S. C. The program has not been received at the time of going to press.

The annual meeting of the Appalachian Engineering Association will be held at Winston-Salem, N. C., May 6 and 7. Henry M. Page, secretary, Morgantown, W. Va.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its semi-annual meeting at Cincinnati, Ohio, May 19 and 20. F. E. Sanborn, secretary, Ohio State University, Columbus, O.

The regular monthly meeting of the New England Water Works Association was held in Boston, March 9. A paper entitled "Double Filtration of Polluted Water" was read by Henry W. Clark, chemist of the Massachusetts State Board of Health. The Board has carried on experiments on double filtration since 1893. Double filtration has been many times proposed for highly polluted water and also for overcoming large growths of algae and similar microscopic organisms. Experiments have been carried on by filtering the Lawrence city water, which has already passed through the city filter; also by double filtration of the Merrimac river water, and of other water much more highly polluted than that. The average results were shown by tables projected upon the screen and indicated that double filtration has no advantage either in bacterial efficiency or in economy in cost of scraping and caring for filters, over single filtration at a reasonable rate, in the case of these waters.

A meeting of the American Institute of Electrical Engineers will be held in Charlotte, N. C., March 30 to April 1.

The next meeting of the Northwestern Clay Association will be held in Minneapolis, Minn., April 6. Alex Anderson, secretary, Minneapolis.

The annual convention of the Illinois Mayors' Association will be held at Cairo, Ill., May 18 and 19. The program will embrace a number of interesting papers on various subjects.

The annual convention of the Illinois Water Supply Association, which was organized in 1909, was held at the University of Illinois (Urbana and Champaign), March 8 and 9. Among the papers presented were the following: "Experience with Deep Well Pumps," F. C. Amsbary; "The Chances of Pollution in Shallow Wells," C. B. Burdick; "The Rate of Flow of Water Into Wells," Prof. A. N. Talbot; "A City Water Supply From Wells," O. T. Smith; "Filtration of Water Supplies," J. Langdon Pearse; "Disinfection of Water," Prof. C. E. A. Winslow; "The Practice and Devices Used in Applying Hypochlorite," H. E. Jerclau; "Bleaching Powder as an Adjunct to Filtration at Quincy, Ill.," W. R. Gelston; "The Quality of the Waters of the Mississippi System," R. B. Dole; "The Significance of the Term Alkalinity in Water Analysis," Prof. E. W. Washburn; "Legislation in Relation to the Pollution of Streams," H. M. Ely; "Water Supplies and Typhoid Fever in Illinois," Dr. Bartow; "The Action of Mississippi Water on Metals," W. F. Montfort; "The Sanitary Conditions of Water in Inlet Tunnels," T. A. Alvord and L. I. Birdsall; "Shall Water Companies Furnish the Private Services Free, Up to and Including Meters?" E. P. Wheeler; "Water Works Franchises," Prof. M. H. Robinson; "A State Bureau of Municipal Information," Prof. J. W. Garner. Officers were elected as follows: President, C. E. Slocum; vice-presidents, O. T. Smith, R. R. Perkins and C. H. Cobb; secretary and treasurer, Dr. Edward Bartow.

The second National Conference on City Planning will be held in Rochester, N. Y., May 2 to 4. The general subject for consideration is "The Problems of Congestion," with many speakers on Tuesday, the 3d, upon the causes and prevention of congestion of population; on Wednesday morning, the 4th, upon the circulation of passengers and freight in its relation to the city plan, and on Wednesday afternoon upon legal and administrative procedure affecting the city plan. There will be an exhibit of city planning and congestion. The entertainment features include automobile tours of the city, a luncheon on Monday and a banquet Tuesday night.

The Cement Products Exhibition Company has had such phenomenal success with the Chicago Cement Show and has had so many requests for a similar exhibition in New York, that it has leased Madison Square Garden from about December

14 to December 20, 1910, and will then hold a great educational show to promote the cement industry in all its branches. It is not believed that the New York show will interfere in the least with the Chicago show. Many exhibitors at the latter have already expressed their intention to exhibit at the New York show.

The American Academy of Political and Social Science will shortly publish a special volume on "Public Recreation Facilities," including parks and playgrounds. This is one of six such special volumes issued to members last year. Eight such volumes have been issued, treating of conservation, city, race, business, industrial and territorial conditions. Three are in preparation for early issue, the other two being on stocks as investments and the administration of justice in the United States.

Secretary J. M. Diven, Charleston, S. C., has published the proceedings of the 29th annual convention of the American Water Works Association, held at Milwaukee, Wis., June 7 to 12, 1909. The volume contains 796 pages and many inserts. The papers are specially full on the subjects of water purification and the boiler-room, but nearly every problem of the water works man has at least one discussion in a paper or otherwise.

The report of the 19th annual meeting of the Massachusetts State Board of Trade contains an address by Charles W. Eliot, ex-president of Harvard College, upon "The Complete Revolution in Business," which shows the modern necessity of an engineering education in most lines of business and, perhaps, will suggest why engineering is becoming each day more of a business and less of a profession, even to some extent in those lines which have been considered strictly professional.

The Bureau of Municipal Research of Philadelphia has been organized under the general supervision of the New York organization with two directors and six assistants. A booklet giving a brief description and a full classification of the work which it is proposed to do has been issued under the title of "Business Methods in Public Business."

The Cincinnati Bureau of Municipal Research, Rufus E. Miles, director, Neave building, has published Paving Report No. 1, relating to wood block paving contracts, being a brief submitted to the Board of Control of the city. It gives a history of the peculiar methods of letting contracts for wood block pavements in 1909, a discussion of the specifications for creosote oil and the adherence thereto. Accompanying is the reply of the Director of Public Service and the reply of Director Miles of the Bureau of Municipal Research thereto, which throw some additional light on the situation, which is not creditable to the city of Cincinnati.

The latest bulletins of the Museum of Safety and Sanitation, 29 West 39th street, New York, give descriptions of linemen's protective shields and guards for window cleaners.

The Civic League of St. Louis, Mo., publishes in attractive form the report of its signs and billboards committee on "Billboard Advertising in St. Louis," showing its atrocities and how they can be abated. The league has recently received much encouragement in its campaign through a decision of the State Supreme Court confirming to the city the right to control billboards by the ordinance passed and under attack.

At the meeting of the Brooklyn Engineers' Club held March 10, W. W. Brush presented a paper on "The Proposed Delivery System for Catskill Water Within the City Limits." The annual smoker of the club will be held at the Imperial restaurant April 7.

At the meeting of the Municipal Engineers of the City of New York, March 23, Alexander Johnson presented an illustrated paper on the Manhattan bridge. An inspection of the Madison avenue bridge over the Harlem river was made March 26.

S. E. Doane, chief engineer of the National Electric Lamp Association, delivered an illustrated lecture in Colonial Hall, Fremont, O., on March 23, before the Electric Light Association.

The American Society of Engineering Contractors has sent out ballots for a new annual election of officers and called an annual meeting for April 12 in New York.

Personal Notes.

W. S. Hill has been elected mayor at Muscatine, Iowa.

H. H. Tracy has been appointed city engineer at Norfolk, Neb.

S. Cameron Corson has been re-elected city engineer at Norristown, Pa.

John M. Dortch, city engineer of Shreveport, La., for four years, died March 1.

Frederick Schafer has resigned as superintendent of water works at South Bend, Ind.

Hon. Charles Scheerer, mayor of Galena, Ill., died suddenly of apoplexy, March 14.

Harry W. Walker has resigned as secretary of the New York Aqueduct Commission.

Hon. William L. Shurtleff, mayor of Cuba, Ill., died March 15 at Moline, Ill., aged 42 years.

William P. Hennessey has resigned as principal assistant engineer of the Borough of the Bronx, New York.

Hudson F. Layton, civil and consulting engineer, has removed his office to 2501 Oliver Building, Pittsburg, Pa.

Lewis W. Anderson has resigned as city engineer of Grand Rapids, Mich., which position he has held for ten years.

David Sloan has been appointed consulting engineer and W. G. Sloan chief engineer of MacArthur Brothers Company.

Hudson F. Layton, civil and consulting engineer, will move, April 1, to suite 2501 Henry W. Oliver Building, Pittsburg, Pa.

H. C. Kittredge, Assoc. M. Am. Soc. C. E., formerly with the American Pipe & Construction Company, of Philadelphia, Pa., and Knight & Hopkins, of Rome, N. Y., have established offices at 42 Werner Park, Rochester, N. Y., and will practice

as designing and consulting engineers on the construction of plain and reinforced concrete structures.

W. M. Bostaple has been elected city engineer at Ogden, Utah, to succeed A. F. Parker, who resigned recently to engage in private practice.

Alexander S. Farmer and William E. Brown have been appointed assistant engineers and designers under the Board of Water Supply, New York City.

James Bell, who has been city engineer at Ft. Thomas, Ont., for 2 years, has resigned. His resignation will not become effective until the end of the year.

H. P. McCabe has been elected president, H. H. Bailey clerk, J. E. Kennedy treasurer, and D. F. Ahearn, J. E. Neaton and Thomas F. Ryan, trustees, at Emmett, Mich.

Walter B. Snow, publicity engineer, rooms 421 to 425, 170 Summer st., Boston, Mass., has largely increased his force and office facilities to accommodate his increasing business.

Henry Maurer has been elected village president, Charles Faymire clerk, Eugene Bartlett treasurer, and Thomas W. McCall, Jacob Mesic and Anson Welch trustees, at Memphis, Mich.

Major Jay J. Morrow, Corps of Engineers, has been relieved of duty in charge of the water supply system of the District of Columbia, and of the improvement of the Potomac river, and assigned to duty at Portland, Ore., in charge of river and harbor improvements in the engineering district, including the territory of Alaska. Major Morrow is succeeded temporarily by Capt. Warren T. Hammon, who has been his principal assistant.

Dr. J. H. Dancey has been elected village president at Capac, Mich. Frank Bent was elected clerk. Frank Bench treasurer, and D. A. McDougall, O. A. Prey and Charles Lang, councilmen.

Harry B. Gunnis has been elected village president, John H. Ihuken clerk, Delancy A. Pontius treasurer, and John M. Druillard, Asa C. Jackson and Charles T. Worthy, trustees, at Algonac, Mich.

S. D. Newton has retired from the office of city engineer of Knoxville, Tenn., and has opened offices as a civil and consulting engineer, making a specialty of municipal work, and also of reinforced concrete structures.

W. Waldo, consulting engineer, has established new offices at 432-4 Commercial National Bank building, Houston, Tex., and has added a department of surveys for the general development of land for the market.

Charles A. Finley, who for seven years has been superintendent of the Bureau of Engineering and Surveys, Pittsburg, has been appointed successor to A. B. Shepherd, who recently resigned as superintendent of the Water Bureau.

E. A. Kingsley, superintendent of public works in Little Rock, Ark., against whom charges had been preferred by one of the aldermen, scored a complete victory at the council meeting held March 3, which thoroughly vindicated him after a detailed investigation of the charges by a committee which had held several hearings.

MACHINERY AND TRADE

A Portable Atlas Dryer.

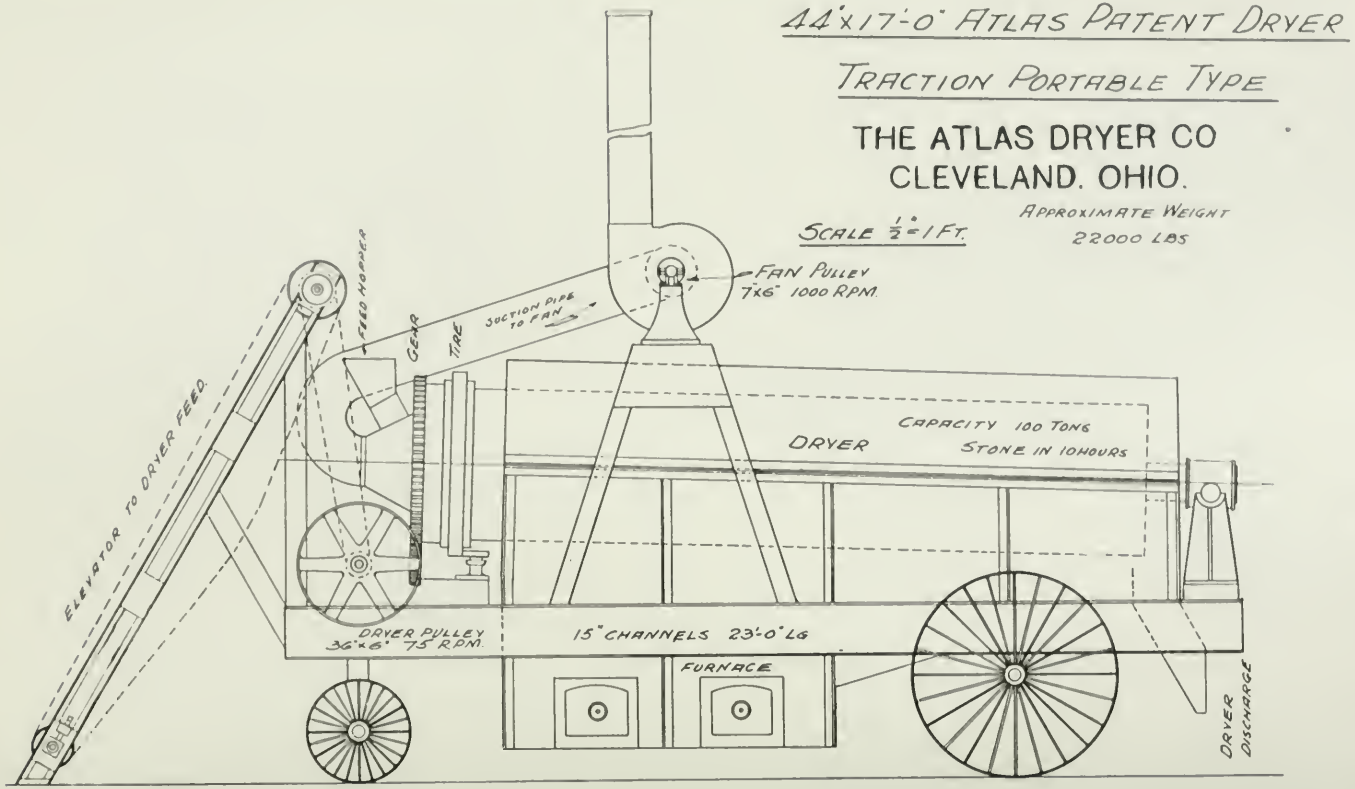
The accompanying cut shows an Atlas dryer portably mounted for transportation over street roadways, the latest achievement of the Atlas Dryer Co., of Cleveland, O., in meeting the coming demand for a dryer or heater which will be available for rural districts and country roads where railroad asphalt plants can not be located close enough to the work to warrant their use. The dryer shown is one of a number of sizes and can be furnished in conjunction with melting tanks, mixer platform and other requirements for an asphalt paving plant, each unit being portably mounted for transportation.

Concrete Spreading Dump Cart.

The Goit Manufacturing Co., Oklahoma City, Okla., has put on the market a standard track dumping cart of 21 cubic feet capacity, which has the smallest possible amount of machinery.

The mechanical design causes the quadrants that form the dumping body to be actuated by gravity, and to assume a vertical when they revolve into dumping position, and the reciprocal motion thereby imparted to the respective quadrants causes the top to roll or close inward, simultaneous with the opening of the bottom, insuring free and unobstructed delivery of the load. The form of the body and the operation are similar to the clam-shell bucket; but each of the quadrants has its own individual pivot points upon which it revolves when released by the dumping lever, causing them to open and dump their load by gravity.

The spread of the quadrants when in dumping position is 21 inches, which is exactly one-half of the measurement of the full spread of the top sides of the body when loaded, consequently the quadrant forming the dumping body must be vertical when dumping. However, the opening may be regulated by the dumping lever so as to discharge the load gradually at the option of the operator.


44'x17'-0" ATLAS PATENT DRYER
TRACTION PORTABLE TYPE
THE ATLAS DRYER CO
CLEVELAND. OHIO.
SCALE 1/2"=1 FT.
APPROXIMATE WEIGHT
22000 LBS
FAN PULLEY
7'x6" 1000 R.P.M.
FEED HOPPER
GEAR
TIRE
SUCTION PIPE TO FAN
ELEVATOR TO DRYER FEED
DRYER
CAPACITY 100 TONS
STONE IN 10 HOURS
DRYER PULLEY
36"x6" 75 R.P.M.
15" CHANNELS 23'-0" LG
FURNACE
DRYER DISCHARGE

The body is of No. 10 steel plates with angle iron reinforcing frame and ends reinforced with ¼ by 3-inch bars, all securely riveted and forming a practically water-tight joint between the two quadrants when closed. The panel plates securing the quadrants in position are bracketed to the axle and braced to the frame. Rollers eliminate friction on pivots and bolts supporting the body.

The frame on which the body is mounted is 5-inch channel iron, secured to the axle by four clips and with heavy angle iron reinforcement at corners.

The single axle extends across and through the panel plates 18 inches above the closure of the body quadrants, so that it does not interfere with the free exit of the load.

Wheels are ample and shafts of gas pipe are secured by clips and bolts to the channel iron frame so that the cart can be readily knocked down for transportation. The company will supply all desired information on request. Contractors and engineers will be specially interested in the economy, durability and strength of this cart.

The Baker Armored Concrete Pavement.

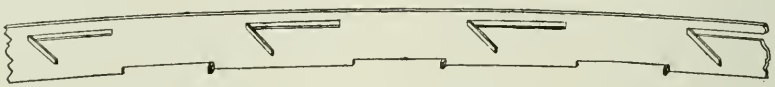
Concrete pavements were laid as long ago as 1890 or 1891, and the first pavements are still in use and in good condition except some wear at the joints. The same complaint of wear at the joints is made concerning numerous other concrete pavements, and to obviate this difficulty the Baker armored concrete pavement was devised.

The R. D. Baker Co., of Detroit, Mich., have prepared specifications for the pavement, which conform to the best practice and if followed by men capable of doing good concrete work, will give a good durable pavement. Excavation to sub-grade and rolling with 7-ton roller is provided; then a foundation, 5 inches thick, of concrete, 1 part cement to 3 parts sand and 6 parts broken stone or pebbles, all absolutely clear of any clay, loam or other foreign matter, and the stone graded from ½ to 2-inch sizes and voids just filled with the sand; then a 2-inch wearing surface of 1 part cement, 1½ parts clean, sharp sand and 3 parts hard-head pebbles not less than ¼ and not more than ½ inch in diameter, the proportion of sand being varied so as to completely fill voids and make a water-tight concrete in both foundation and wearing surface.

Then expansion joints ½ inch wide are provided for, extending from curb to curb every 25 feet and wherever necessary to provide for expansion and contraction. When the concrete is being placed, a dividing board will be put in place to fill the opening for the joint. This board will be shaped to the crown of the street. To it will be clamped angles or ¼-inch steel plates, 3 inches wide, also shaped to conform to the crown of the street. These plates are provided with "shear members," which tie them securely to the concrete base and wearing surface. After the pavement is finished the dividing board is removed and the opening is covered with tar paper until it can be filled with No. 6 paving pitch or other specific filler. Mr. Baker provides for securing a uniform surface with an iron-shod "strike," rigid and unyielding and shaped to conform to the crown of the finished pavement, which is so used as to leave the surface a trifle rough and gritty, thereby affording a good foothold for horses.

The plate armor for the edges of the blocks prevents the blow of wheels against the thin edge of concrete, and thus the breaking of this edge, the consequent increase in width of joint, the heavier blows on the concrete and the further disintegration are prevented.

Concrete pavements have usually been restricted to the more lightly traveled streets, but with Mr. Baker's steel plate armor it would seem that they could be used on streets of the heaviest traffic, since the wear on joints is the most serious complaint against concrete pavements as well laid as Mr. Baker's specifications provide and with the rough surface which he prescribes.



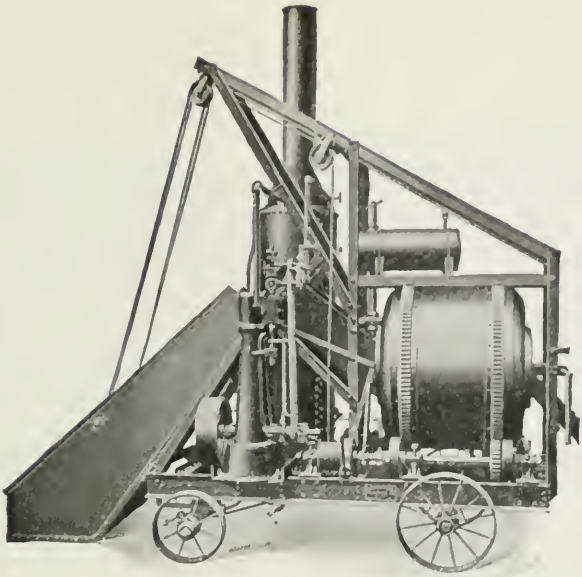
REINFORCING JOINT PLATE FOR BAKER'S REINFORCED CONCRETE PAVEMENT.

The accompanying cut shows the armor plate with the projecting "shear members" which have been partly cut out of the plate and bent back so as to project into the concrete and be held by it.

A Successful Concrete Mixer.

There are so many concrete mixer patents granted these days that one who does not know the records of performance of the machines may easily go astray. The Koehring mixer is one which has demonstrated its adherence to the four cardinal points in a mixer, durability, simplicity, reliability and economy. A recent catalog shows many photographs of Koehring mixers on the work, and photographs of car loads of them on the way to Seattle and Los Angeles, showing that their good qualities are known very widely.

The first of the accompanying cuts



1. KOEHRING CONCRETE MIXER.
No. 1-B on Trucks With Elevating Charging Bucket and Water Measuring Tank.

2. KOEHRING CONCRETE MIXER.
No. O Street Paving Mixer With Steam Engine, Boiler, Elevating Charging Bucket and Water Measuring Tank.

shows mixer 1-B on trucks, equipped with elevating charging bucket and water measuring tank. This mixer has a capacity of 11 cubic feet of the materials, which are shoveled into the charging bucket, which is then tipped up by means of a hoisting drum. The batch, when mixed, is discharged on the opposite side by throwing the discharge chute into position. Discharge is stopped instantly by throwing the chute out of that position. The machine will turn out 14 cubic yards of mixed loose material per hour at a drum speed of 17 revolutions a minute, using a 6-horsepower steam engine or a 7-horsepower gasoline engine.

The second cut shows the No. 0 street paving mixer with steam engine, boiler, elevating charging bucket and water measuring tank. This mixer has a capacity per batch of 9 cubic feet per hour of 14 cubic yards of loose materials, or 75 square yards of street, and will keep 17 men busy supplying material and placing it in the street, including engineer and foreman. An attachment of boom and traveling bucket can be put on, which will deliver the material at any desired point of the street width within the reach of the boom.

The Koehring Machine Co., Milwaukee, Wis., will send on request a catalog showing the various styles and sizes of mixers and the attachments. The catalog describes in full the methods of construction of the machine and the reasons for its economy and durability. It also shows the various attachments, such as water measuring tank, a concrete hoist to be run by the same engine as the mixer, the hoisting drums and stone crusher, crushed stone elevator, and screen, an excavating loader, and wheelbarrows of their manufacture. Full instructions are also given for setting up and running the machinery.

Sandstone Curbing.

The best proof of the durability of curb is the reference to the streets on which it has been used and for this reason the accompanying photographs are shown. The first shows Magnolia Drive, Wade Park, Cleveland, O., with Berea sandstone curbing which has been in use for 30 years. The second shows a Berea sandstone curb which has been in use on N. Prairie st., Bloomington, Ill., for 18 years or more. The writer has seen both of these streets and the curbs show the same perfection of outline that is indicated by the small size photographs. He has also seen the limestone curb on E. State st., Columbus, O., shown in the third photograph, in use some 12 or 15 years, and knows that its condition is not exaggerated by the camera. These are quite convincing evidences of the durability of sandstone curb and of the lack of durability of some kinds of limestone curb.

The Berea sandstone from the quarries of the Cleveland Stone Co., at Berea, O., contains 96.90 per cent. of silica and has a crushing strength of 10,000 pounds per square inch. The quarry is fully equipped with machinery for cutting curb in any desired style. The standard style is machine dressed with "bull nose" or rounded corner. The top and face are

1. BEREA SANDSTONE CURBING IN CLEVELAND, O.
In Use 30 Years, Magnolia Drive, Wade Park.

tooth-chiseled by the machine before shipping. The back and ends are left rough and are dressed after the stone is delivered on the ground. The dressed

ble and hundreds of miles of curbing are shipped each year. Full information will be supplied by the Cleveland Stone Co., Cleveland, O.

2. SANDSTONE CURB IN BLOOMINGTON, ILL.
In Use 18 Years on N. Prairie St.

LIMESTONE CURB IN COLUMBUS, O.
Almost Disintegrated on E. State St. After 12 to 15 Years Use.

curb is also furnished with a straight edge if desired, though most shipments have the bull-nose. There are also many shipments of undressed curb.

The quarries are practically inexhaust-

An Automatic Letterer.

Ralston J. Markoe, 14 Summit avenue, St. Paul, Minn., has copyrighted a device for saving time in drawing letters on building plans, maps and other drawings,

leaving the tracing only of the letters to be done. It contains 32 standard alphabets of different sizes, with the corresponding numerals, besides many words and phrases in common use upon drawings. Extra large letters and numerals are available for drawings that are to be reduced photographically.

The operation of the device is very simple and it will be found very convenient for making up titles on the tracing cloth copies of drawings. Mr. Markoe will send it by mail postpaid for $1.

Aquabar for Waterproofing.

Aquabar is a water-proofing material which is mixed with the water used for mixing concrete. It crystallizes in chemical combination with the cement and forms a part of the concrete mass and makes it waterproof. It has long been used in Germany and by the U. S. government, and is specified by many prominent architects.

The Girvan-Nachod Co., general sales agents for the Aquabar Co., 1228 Locust St., Philadelphia, will send full information on request.

Briggs Concrete Spreader and Dump Carts.

The Briggs Labor Saving Specialty Co., Waterloo, Iowa, have had on the market for about 5 years a concrete spreader cart which has had great success on account of its attractive features. It is a 2-wheeled cart of No. 10 and 12 steel plate reinforced with steel angles. Leaves in the bottom open by gravity on being tripped from the cart handle, letting the concrete drop in a manner to spread it thoroughly. The cart is so well made that the makers guarantee that contractors spend less money on repairs for them than on any other class of equipment on their work.

They also make a water-tight steel tip-over dump cart, the bed or hopper being hung on a round steel axle with enough excess weight above the axle when loaded to dump the load when the lock is released. This cart holds 12 or 15 wheelbarrow loads and can be used with any batch or continuous concrete mixer. It Ft. Worth, Tex., four carts hauling 300 feet keep a ¾-yard batch mixer going, and on 100 foot haul two carts keep it busy. The combination has put in 168 cubic yards of concrete street foundation in a day.

The company also sells harness for the cart horses. Send to them for full information.

McGraw Electrical Directory.

The McGraw Electrical Directory, published semi-annually in April and October at $10 a year covers the lighting and power field thoroughly. It gives a list of central electric stations in the United States, Canada and Mexico, with names of officers and abstract of equipment and business, with a summary and index; a classified directory of manufacturers of apparatus for such stations; a list of electrical supply dealers and contractors; a dictionary for buyers, consisting of concise descriptions of electrical apparatus and equipment furnished by advertisers in the book; a list of electrical fittings approved by the National Board of Fire Underwriters; reference tables. and the officers of the electric light associations of the country. The lists are guaranteed by an offer of $1 to subscribers and advertisers for every six envelopes returned by the post office undelivered.

The book is indispensable to those in its field.

A Cement Booklet.

A 36-page copyrighted booklet has just been published by the Superior Portland Cement Co., whose offices and sales department are in the Union Trust Building, Cincinnati, O. The spokesman is Mr. J. B. John, general manager, who built the model Superior mill at Superior, Lawrence county, Ohio. The reader takes a little journey with Mr. John from the quarries to the market, each step in the process of Portland cement manufacture being explained on the way. This lucid booklet is well typed, illustrated and printed, and will certainly be perused with interest alike by engineers, contractors, dealers and users of Portland cement. As the Superior raw material runs very low in magnesia, there is a printed chapter on this subject, as also numerous birdseye views of "Superior monuments," showing many important works where Superior cement has been used. Booklet C 9 will be mailed on request.

Corrugated Metal Culverts.

The receipt of two new booklets from the Canton Culvert Co., Canton, O., calls for some notice of their handsome appearance and the excellent manner in which the information they contain is presented.

The Acme nestable corrugated metal culverts are worthy of the attention given them, and the illustration in the pamphlets show the work which they are required to do and which they are able to sustain.

One of the booklets is devoted to steam and electric railways and shows culverts 15 to 60 inches in diameter, of 12 to 16-gauge metal under fills of 3 to 33 feet depth.

The other pamphlet shows the adaptability of the Acme culvert to highway work and shows culverts up to 72 inches in diameter.

This culvert has a number of advantages some of which may be recapitulated. The metal is practically pure iron and loses 2.7 per cent. on immersion in a 20 per cent. solution of sulphuric acid at atmosphere temperature as compared with

a loss of 83.2 per cent. by steel under the same conditions. The corrugated semicircular sections break joint top and bottom so as to make the culvert all of the same strength. The top and bottom sections are fastened together so as to retain their relative positions and they overlap the adjoining sections longitudinally so that they are equally well joined both ways. The sections are nested together for shipment so that the plates for a culvert 40 feet long can be carried by one man.

The culverts are fully guaranteed for 25 years.

The booklets should be sent for on account of the valuable information they contain concerning culvert construction, as well as the instruction about the uses and varieties of the Acme and Imperial No-Co-Ro metal culverts themselves.

A Spanish folder tells the tale in that language also.

Cost of Sewer Cleaning in New York City.

The following table shows the mileage of sewers in the borough of Manhattan, New York City, for each year since 1886, the number of miles of sewers cleaned each year, and the cost of cleaning these sewers per mile.

Year.	Miles of Sewers.	Miles Cleaned.	Cost per Mile.
1886	411.20	10.6	$2,050
1887	421.51	15.2	1,210
1888	429.09	19.3	1,370
1889	433.73	30.5	1,000
1890	437.89	45.6	810
1891	444.29	25.2	690
1892	449.37	14.7	760
1893	455.80	17.6	750
1894	461.52	14.9	640
1895	468.20	12.0	630
1896	472.18	36.5	780
1897	483.06	47.6	710
1898	484.35	43.8	640
1899	489.05	44.4	1,520
1900	494.57	56.6	980
1901	496.94	66.2	980
1902	500.59	85.6	690
1903	505.08	124.5	470
1904	507.64	132.6	470
1905	511.36	99.7	660
1906	513.77	144.8	510
1907	517.97	205.6	490
1908	521.67	218.7	440
1909	523.34	248.8	360

Placing Concrete in Freezing Weather.

There is a doubt in the minds of a number of well known chemists as to the action of salt on concrete. Whether it is injurious or not, there is always some likelihood of efflorescence resulting after the concrete has thawed and warmer weather sets in. Therefore, I would suggest the following method of placing concrete in freezing weather, the thermometer not to be below plus 20 degrees F.

If a machine mixer is used, mix and place immediately one batch at a time. If hand mixing is used, do not mix over a two bag batch and place immediately. Heat the sand and stone by piling over a sheet metal arch or a large cast iron pipe, building the fire under the arch or in the pipe, the pipe to be tilted so as to form a draught. Heat the water as hot as possible in a kettle, or use water from a steam boiler.

The action of hardening is thus stimulated and the concrete will not cool before it has set hard. If the weather continues below freezing leave the forms in place until the temperature is above plus 40 degrees F., the action of crystallization will then continue.

(From instructions by Albert Moyer, sales agent Vulcanite Portland Cement Co., New York City.)

Trade Publications.

The latest Lehigh Portland Cement Co. publications are mainly given up to reinforced concrete bridge construction, with many pictures of buildings and other structures using large quantities of Lehigh cement, and the water filtration plants at Louisville and Ashtabula, O.

The Ansonia Mfg. Co. issues a pamphlet describing and illustrating their apparatus for controlling the flow of sewage from septic tanks.

The Business Men's League of St. Louis issues a booklet on St. Louis in 1910 which is crowded full of facts about the fourth city in the United States.

Bulletin No. 70 of the Universal Portland Cement Co. is devoted to concrete in mine construction, a new reinforced concrete building of the Studebaker Bros. Mfg. Co. in Chicago and concrete in the city beautiful.

The March bulletin of the Edison Portland Cement Co. is filled with pictures of reinforced concrete buildings, in which Edison cement has been used.

The Reinforced Concrete Co. of St. Louis, Mo., formerly the Reinforced Concrete Construction Co., announce the reconstruction of their business to the engineering features of reinforced concrete construction in a booklet which is unique in form and a very convenient compound of pictures of work done by the company, statements of buildings designed and constructed by them, standard specifications for reinforced concrete buildings and drawings of designs for details and a large arch bridge.

The American Telephone & Telegraph Co. has issued its annual report for 1909 to stockholders.

J. W. Howard, consulting engineer on roads, streets and pavements, 1 Broadway, New York, sends a letter setting forth the facilities of his office for designing pavements, inspecting and testing materials and construction.

The Dunn Wire Cut Lug Brick Co., Conneaut, O., issue a circular describing Dunn's reciprocating automatic cutter for cutting paving blocks and face building brick, with or without round edges, grooves in ends, manufacturer's brand on one end or any configuration desired to be stamped on the face of the brick, thus

showing the adaptability of the apparatus to required conditions.

A handsome special publication of the Universal Portland Cement Co., on which a price of 50 cents is set, is entitled "Representative Cement Houses" and shows many handsome photographs of residences and of outside finishes for cement work.

The Patten Mfg. Co. make Patten double platform hoists with winches and motors, which are shown in Bulletin 101.

The Clinton Wire Cloth Co. has begun the publication of a series of descriptions of work done with their materials under the title "Steel Fabric."

The Ruggles-Coles Engineering Co., Chicago and New York, have issued a new catalogue of their dryers which gives full illustrated descriptions of construction, operation, capacity, dimensions, economy and results of tests of their Class A dryer, and shorter descriptions showing the variations in dryers of Classes B, C, D, E, F and of special dryers, the various materials requiring modifications of construction and operation to fit the conditions. The booklet also has many reproductions of commendatory letters from cement, plaster, sand, stone, asphalt and other companies and a list of the many purchasers of the Ruggles-Coles dryers.

Troy dump wagons and dump boxes are well described in two handsome circulars issued by the Troy Wagon Works Co., Troy, O., which show the reasons for the great popularity of these efficient "wagons of performance."

Wahsatch structural paint for bridge and structural steel and iron work is described in a large circular and shown to be a "low-priced paint with a high-price record," issued by the American Asphaltum and Rubber Co., Chicago, Ill.

Jefferey rubber belt conveyors are described and price listed in Booklet No. 35 of the Jeffrey Mfg. Co., Columbus, O.

The March "Pipe Parley" shows several large cast-iron pipe T's which have recently been completed at the Radford, Va., works of the McWane Pipe Works for the Panama canal.

The "Farm Cement News," issued monthly by the Universal Portland Cement Co., gives detailed instructions for doing concrete work on the farm.

The Chain Belt Co. issue a catalogue of chain belt concrete mixer.

Trade Notes.

ASPHALT.

Emeryville, Cal.—Special.—R. L. Hawley, cy. engr., is in the market for an asphalt repair plant.

Kansas City, Kan.—The Rackliffe-Gibson Co. will begin at once the erection of a paving plant for the construction of Hassam pavement.

CEMENT.

Philadelphia, Pa.—The United States court appointed, March 4, William E. Erdell of Allentown, Pa., receiver for the Penn Allen Portland Cement Co., whose plant is situated at Nazareth, near Allentown.

Omaha, Neb.—The Nebraska Portland Cement Co., with general offices in the Omaha National Bank Bldg., will begin the work of construction on its plant, to be located at Superior, Neb., within two months. The officers of the company are: President, C. McLaughlin; treasurer, C. E. Adams; secretary, H. G. Calkins.

Nazareth, Pa.—The Crichfield Portland Cement Corporation, with headquarters here, will begin the construction of a plant near Knoxville, Tenn., this spring. S. Henry Harrison is engineer for the company.

Atlanta, Ga.—The Georgia Portland Cement Co. contemplates building a plant this spring.

The Pittsburg Architectural Club has distributed the $500 in prizes for designs of a suburban concrete residence and garage, offered by the Universal Portland Cement Co., five of the eight prizes and honorable mentions going to competitors in Pittsburg and vicinity, two to Brooklyn and one to Boston.

Wm. E. Dee Co. move on May 1 to 1026-30 Chicago Stock Exchange Bldg., 108 LaSalle st., Chicago, Ill.

CONCRETE BLOCKS.

Tucson, Ariz.—The Gates Reinforced Concrete Railroad Tie Co. has been incorporated by Frank Ross, T. T. Tourtillott, J. H. Jarman, George Gates and James R. Kidward.

Grand Junction, Col.—The Modern Construction Co. has been incorporated to manufacture concrete and clay products and to conduct general construction business. The officers of the company are: President, G. H. Wiltse; secretary and treasurer, O. B. Lopstedt.

PURCHASE OF MACHINERY.

Emeryville, Cal.—Special.—R. L. Hawley, cy. engr., is in the market for an asphalt repair plant.

Honolulu, Hawaii.—Special.—John H. Wilson, road supvr., advises us that he is in the market for road machinery.

Eau Claire, Wis.—The Gisnau Mfg. Co. has been incorporated to manufacture cement weighing and other machinery, by Peter Gisnau, E. F. Bolte and H. J. Schneider.

Paris, France. — Special. — Arthur H. Blanchard, care American Express Co., 11 Rue Scribe, desires catalogs of asphalt macadam mixing machinery and bituminous material distributors.

Litchfield, Ill.—Special.—David Davis, chmn. com. on industries, says the citizens, headed by the Merchants' Association, are endeavoring to induce the city council to establish some regular system of cleaning the brick-paved streets, which may result in the purchase of some street-sweeping machinery and sanitary carts or dump wagons before the season is over.

North Adams, Mass.—(Special). Clifford C. Haskins, 41 Highland ave., is in the market for a transit.

Henry, Tenn.—(Special). J. H. Hoskins, C. E., care Good Roads Contracting Co., advises us that he is interested in the question of purchasing road and street paving machinery.

Orange, N. J.—(Special). John Harms, 50 Casey st., advices us that he desires to purchase a small concrete mixer, with gasoline power, plow for grading, and a horse scraper.

PURCHASE OF MATERIALS.

Paris, France. — Special. — Arthur H. Blanchard, care American Express Co.,

11 Rue Scribe, desires to purchase bituminous materials.

Kalispell, Mont.—Special.—Northern Idaho & Montana Power Co. is in the market for pig lead, calking tools, etc.

Ashtabula, O.—Special.—Charles Huckarl, 52 Cherry st., Ashtabula Harbor, desires price list on sewer pipe.

Port Huron, Mich.—Special.—E. B. Whitmore, cy. engr., desires names of firms handling rock asphalt.

Aurora, Ill.—(Special). J. E. Saltsberg & Co., desires to communicate with firms manufacturing special rail brick.

Henry, Tenn.—(Special). J. H. Hoskins, C. E., care Good Roads Contracting Co., is in the market for macadam builders.

MISCELLANEOUS.

Albert Lea, Minn.—The American Culvert Co. has been organized by E. Pankhurst, A. G. Bisbee, E. H. Loomis and Bert Bisbee, of Lyle, Minn., and T. V. Knatvold and C. L. Sirenson of this city.

Aberdeen, Wash.—The Aberdeen Glazed Cement Pipe Co. has been incorporated by Chas. F. Allen, J. C. Smith and J. A. Pinkney.

The H. Cole Co., drafting and engineering supplies, have removed to 43-5 E. Long St., Columbus, .

The Barron & Cole Co. of New York City, owing to the increased demand in second-hand contractors' equipment are opening up a special department to handle this particular line, and have put Mr. George E. Ray in charge as manager, formerly of the Russell Contracting Co., also of New York.

Stone & Webster Engineering Corporation in addition to strictly engineering work have over $11,000,000 of construction contracts under way, waterpowers, interurban railways and buildings in the western states constituting a large majority of their work.

The Robins Conveying Belt Co. have moved their executive, sales, engineering and purchasing departments to the Park Row Building, New York.

At the annual meeting of the board of directors of the Keller Manufacturing Co., Philadelphia, the following officers were elected: Julius Keller, president; W. P. Pressinger, Wm. H. Keller, S. W. Prince, vice-presidents; Francis J. Rue, treasurer; C. S. Bell, secretary. The Keller Manufacturing Co. of Philadelphia has purchased the business of the W. P. Pressinger Co. of New York, its general eastern distributer and distributer for Michigan, and this territory will hereafter be handled direct by the Keller Manufacturing Co. Mr. J. J. Swan, secretary of the W. P. Pressinger Co., will be associated with the Keller Manufacturing Co. Mr. Charles Strader has been placed in charge of western agencies with offices at Chicago and Lincoln, Nebraska.

Patents Concerning Cement Blocks, Bricks and Artificial Stone (Continued).

903,734. Divided Bond for Two-Membered Concrete Building Blocks. Ludwig B. Larsen, Portland, Ore.

903,906, 903,907, 903,908. Interlocking Brick, Building Brick or Block and Machine for Making. Joseph Soss, New York, N. Y.

903,916. Machine for Making Concrete Slab. Ora D. Tegarden, Columbus, Tenn.

904,513. Machine for Molding Concrete Building Blocks. Chas W. DeArmon and John L. McKinney, Piqua, O.

904,588. Building Block and Wall Constructed Thereof. Wm. T. Wightman, Half Moon Bay, Cal.

904,927. Mold for Building Blocks. Wm A. Boeck, South Omaha, Neb.

907,299. Machine for Making Cement Building Blocks. Alfred Stroeh, Hooper, Neb.

907,699. Building Block. Wm. D. Moore, Creston, Iowa.

908,018. Cement Block Machine. Paul A. Lawin, Long Prairie, Minn.

909,792. Facing Artificial Stone. John C. Henderson, Oakland, Cal.

910,571. Reinforced Molded Building Block. Geo. A. Peterson, Oakland, Cal.

911,110. Mold for Building Blocks. Wm. N. Box, Northfield, and Haughton Brown, Minneapolis, Minn.

911,547. Process for Hardening Calcareous Artificial Stone Substances by Means of Carbonic Acid. Erich Schwanenberg and Albert Rinne, Hanover, Germany.

912,057. Concrete Shingle. Emery P. Anger, Corinth, Miss.

912,080. Cement Building Block. John Crawford, Millinocket, Me.

912,367. Mold for Artificial Stone or Concrete Posts. Orville Dougherty, Jas. W. and Adam E. Armstrong, Three Rivers, Mich.

913,116. Mold for Molding Concrete Blocks. Anton Evenstad, Lakota, N. D.

914,367. Concrete Block Machine. Emery P. Auger, Corinth, Miss.

914,507. Concrete Block. Herbert N. Pettigrew, New Orleans, La.

915,283. Mold (for Gutter Tiles). Wm. E. Frost, Highland Mills, N. Y.

915,287. Mold for Concrete Sign Posts. Leo G. Haase, Pasadena, Cal.

915,517. Machine for Making Concrete Blocks. Peter Wecht and John Winfield, Fostoria, O.

915,556. Cement Block Machine. Oscar Coon, Chicago, Ill.

915,982. Gage for the Spacing Apart of Concrete Building Block. Clawson M Maddox, Muncie, Ind.

916,200. Molding Concrete Blocks. Henry Briggs, Hasbrouck Heights, N. J.

916,409. Artificial Stone. Chas. A. Begle, Ann Arbor, Mich.

916,687. Cement Building Block. Chas. W. Everett and Earl Asheraft, Dresden, O.

916,689. Concrete Block Mold. Wm. H Faulkner, Delta, Colo.

917,004. Manufacture of Blocks, Plates and Other Articles for Use in Road Making, Building, and for Similar Purposes. Harold M. Clifford, Westminster, Eng.

917,141, 917,142. Apparatus for Molding Concrete. Jos. F. Ross, Ipswich, Mass.

12,935 (Reissue). Centrifugal Block Machine. Menzo Nashold, Davis Junc., Ill.

917,930. Building Block. F. A. W. Davis, Indianapolis, Ind.

919,891. Mold for Forming Artificial Stone Blocks. Edward M. Lane, Haddon Heights, N. J.

920,212. Building Block and Wall Constructed Thereof. Sutton Strong, Terre Haute, Ind.

920,851. Concrete Block Machine. Lewis Flanagan, Denver, Colo.

921,287. Machine for Stamping Concrete Blocks and the Like. Hugo Schmidt, Charlottenburg, Germany.

921,659. Machine for Making Concrete Blocks for Buildings. Wm. G. Bailey, Dublin, Ireland.

922,594. Building Block. Roy E. Keagle, Lodi, Cal.

922,997. Concrete Mold. Wm. H. Alexander, Long Branch, N. J.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

New Orleans, La.—This city brought suit in the civil district court, March 9, against the Sicilian Asphalt Paving & Construction Co. and the American Bonding Co., of Baltimore, for $14,898.97, which the city claims is due it by reason of the defendant paving company having paved certain streets which had later to be repaved by the city at an expense amounting to the sum sued for. The bonding company is sued because it is alleged to be the surety in the paving company's contract.

CONTEMPLATED WORK.

Dayton, Wash.—Paving is contemplated for Main st.

Dallas, Tex.—Paving is contemplated for Commerce st.

Watkins, N. Y.—Paving is contemplated for Franklin st.

Owatonna, Minn.—The question of paving is being urged.

Kokomo, Ind.—Paving is contemplated. J. H. Watson, cy. engr.

San Diego, Cal.—Paving is contemplated for 4th, 1st and E sts.

Bakersfield, Cal.—Paving is proposed for K, 23d, 24th and 25th sts.

Bartlesville, Okla.—This city contemplates paving 96 blocks of streets.

Youngstown, O.—Paving is contemplated for Breaden and Broadway sts.

North Yakima, Wash.—Bids will be opened about April 5 for 29 blocks of paving.

Pasadena, Cal.—The city council has decided to pave Holliston ave.

Atlanta, Ga.—Paving is contemplated for Spring st. at a cost of $20,000.

Moline, Ill.—A resolution has been passed for paving 55th st. and 4th ave.

Chariton, Ia.—A resolution has been passed to pave Auburn ave. and Grund st.

St. Joseph, Mo.—Ordinances have been passed for paving 33rd st. and Kansas ave.

Normal, Ill.—An ordinance has been passed to pave Main st. with Posten vitrified block.

Hammond, Ind.—Plans have been completed for paving Highland st. Otto H. Duelke, cy. clk.

Georgetown, Wash.—An ordinance has been passed for paving Rainer ave. with vitrified blocks.

Algona, Ia.—This city contemplates paving 10 blocks with brick. S. W. Crowell, cy. clk.

Wilkesbarre, Pa.—Brick or asphalt paving is contemplated for Barnum Place and Wyoming st.

Atlantic, Ia.—A petition has been submitted to council asking that W. 6th st. be paved.

Greenwood, Ind.—About 8 blocks of brick paving is contemplated. L. E. Pritchard, pres. town bd.

Albert Lea, Minn.—Paving is contemplated for Main st., but the material has not yet been selected.

Sandusky, O.—A resolution has been passed to pave 6 blocks of Washington st. with asphalt or brick.

Marshalltown, Ia.—Council voted to construct about 4000 sq. yds. of brick paving and 3000 ft. of curbing.

Norfolk, Va.—Paving is contemplated for Omohundro and Moran aves., 10th, 4th and other streets.

Hackensack, N. J.—The board of chosen freeholders has decided to construct about 15 miles of roads.

Evanston, Ill.—An ordinance has been passed for paving Dartmouth Place with macadam. J. H. Mowe, comr. pub. wks.

Louisiana, Mo.—About 7 blocks of vitrified brick paving is contemplated. H. J. Findlay, cy. clk.

Alvin, Tex.—This county may vote on the question of issuing $250,000 bonds for constructing good roads.

Toledo, O.—This city contemplates the construction of 9 blocks of concrete paving. J. M. Idchty, cy. clk.

Greenfield, Ia.—Plans are being prepared for constructing 1 mile of vitrified brick paving. Geo. B. Musmaker, mayor.

Pasadena, Cal.—Vitrified brick paving and cement walks are contemplated for S. Broadway. Hieman Dyer, cy. clk.

Mt. Pleasant, Ia.—A contract will be let soon for constructing 35 blocks of brick paving. C. E. Waterhouse, cy. engr.

Floodwood, Minn.—The construction of new sidewalks and grading and improving the streets is contemplated. John Stokke, pres. vil. coun.

Akron, O.—Ordinances have been passed providing for the improvement of Wabash, Dock, Paige, Moeller, Edgewood, Berry and Glenwood aves.

Mt. Vernon, Ill.—Plans have been completed and bids will be asked about May 1 for vitrified brick paving. L. C. Morgan, mayor.

Billings, Mont.—This city is considering plans for constructing $200,000 worth of vitrified brick and creosoted wood block paving.

Atlanta, Ga.—A macadamized boulevard from Ponce de Leon ave. in the Druid Hill section to the courthouse in Decatur, is contemplated.

Goshen, Ind.—The property owners in S. Main st., from Douglas st. to College ave., have petitioned for vitrified brick paving. S. F. Spohn, mayor.

Washington, N. C.—This city has decided to expend $30,000 for paving the streets with macadam and constructing concrete sidewalks. D. B. Packard, cy. engr.

Jackson, Miss.—An ordinance has been passed providing for about 45,000 sq. yds. of paving. The material has not yet been decided upon. B. H. Klyce, cy. engr.

Asheville, N. C.—The city engineer has been directed to prepare specifications for paving Jefferson drive, Clayton, Flint, Hillside, Cherry and Chestnut sts. and Montford ave.

Stockton, Cal.—Specifications are being prepared and bids will be asked about April 1 for improving Cherokee, Waterloo, and Linden roads. F. A. Eckstrom, secy. county highway com.

Cedar Lake, Minn.—Resolutions have been passed by the good roads committee of the Commercial Club providing for the

improvement of 6 miles of roads immediately adjoining the city.

Shawnee, Okla.—The chamber of commerce voted to ask the mayor and council to call an election to vote on the question of issuing $200,000 bonds for the purpose of constructing a boulevard.

Leetonia, O.—Special.—Plans and specifications are being prepared and the contract will be let in April for about 3000 lin. ft. of brick paving. R. R. Stockwell, cy. engr.; F. A. Whittacker, cy. clk.

Richmond, Ind.—The trustees will make a report April 9 on the question of improving the National Road from W. 5th st. 3 miles west. L. M. Pierce, Hagerstown, and E. S. Marthndale, Greensport, trustees.

Peoria, Ill.—The paving contemplated in this city, involving about 12 miles of Westrumite, is proposed for a system to include Hillyer and Elizabeth sts. and Harris ave. Another boulevard place has been suggested for Perry ave.

Philadelphia, Pa.—According to reports submitted to Mayor Reyburn, March 3, by Chief McLaughlin of the Electrical Bureau and Director Stearns of the Public Works, it will require $4,000,000 to put into effect the proposition to pave all main streets between Vine and South sts., Delaware and Schuylkill rivers, and to illuminate them as Market st. is now lighted east of Juniper st.

CONTRACTS TO BE LET.

Fowler, Ind.—Bids are asked until April 9 for constructing 4 roads. Lemuel Shipman, co. audt.

Muncie, Ind.—Bids are asked until April 8 for improving a highway. Joseph E. Davis, co. audt.

Tipton, Ind.—Bids are asked until April 4 for constructing 2 stone roads. J. F. Barlow, co. audt.

Harrisonburg, La.—Bids are asked until April 4 for improving 25 miles of road in Catahoula Parish, La. Police Jury.

Rockville, Ind.—Bids are asked until April 15 for constructing a gravel road. H. A. Henderson, co. audt.

Delphi, Ind.—Bids are asked until April 4 for constructing 3 gravel roads. M. G. Haun, co. audt.

Decatur, Ind.—Bids are asked until April 4 for constructing 4 macadam roads. H. S. Michaud, co. audt.

Duluth, Minn.—Bids are asked until about April 15 for paving Garfield ave. T. McGilvray, cy. engr.

Williamsport, Ind.—Bids are asked until April 4 for constructing a gravel road in Gill twp. B. C. Crowder, co. audt.

Bozeman, Mont.—Bids are asked until April 7 for constructing cement sidewalks, curbs, etc. Cy. clk.

Eveleth, Minn.—Bids are asked until April 5 for 9700 sq. yds. of paving in Grant ave. D. P. McIntyre, cy. clk.

Monticello, Ind.—Bids are asked until April 5 for constructing a gravel road in Liberty twp. A. G. Fisher, co. audt.

Clarinda, Ia.—Bids are asked until April 12 for constructing 20,500 sq. yds. of concrete paving. C. W. Stuart cy. clk.

New Castle, Ky.—Bids are asked until April 12 for constructing about 41 miles of turnpike roads. S. Bruce, Judge Henry Co.

Madison, Ind.—Bids are asked until April 7 for constructing a road in Monroe twp. Gaylord F. Crozier, co. audt.

Minneapolis, Minn.—Bids are asked until April for repairing roads Nos. 5 and 8. Hugh R. Scott, co. audt.

Frankfort, Ind.—Bids are asked until April 6 for constructing 6 gravel roads. C. F. Cromwell, co. audt.

Cleveland, O.—Bids are asked until April 6 for improving Woodland road No. 2. A. B. Lea, dir. pub. service.

Fremont, Mich.—Bids are asked until April 4 for constructing 8129 lin. ft. of paving in Main and Stewart sts. Vil. clk.

Rushville, Ind.—Bids are asked until April 4 for constructing a macadam road in Richland twp. Jesse M. Stern, co. audt.

Kokomo, Ind.—Bids are asked until April 15 for constructing a gravel or stone road in Center twp. A. B. Easterling, co. audt.

Carrington, N. D.—Bids are asked until 8 p. m. April 4 for constructing cement sidewalks and crosswalks. M. L. Winterer, cy. audt.

Upper Alblon, Ill.—Bids will be asked about May 1 for paving Edwards, Brown, Mills and Averill sts. B. B. Stakemiller, cy. engr.

Corydon, Ia.—Bids are asked until April 4 for one-fourth of the road work for the year 1910. J. A. Wade, twp. clk. of South Fork.

Cando, N. D.—Bids are asked until 8 p. m. April 4 for constructing cement sidewalks and street crossings. H. D. Skinner, cy. audt.

Spokane, Wash.—Bids are asked until April 5 for asphalt and brick paving in Browne's addition, including 22 streets and avenues. B. P. W.

Augusta, Ga.—Bids are asked until April 4 for paving 3500 sq. yds. of North Boulevard with creosoted wooden blocks. R. M. Clayton, cy. engr.

Atlanta, Ga.—Bids are asked until April 4 for paving 35,000 sq. yds. of North Boulevard with creosoted wooden blocks. R. M. Clayton, cy. engr.

Albany, N. Y.—Bids are asked until April 4, 6 and 8 for improving a number of highways. S. Percy Hooker, chmn. State Com. of Highways.

Fargo, N. D.—Bids are asked until April 4 for constructing tile, cement, concrete and tar concrete sidewalks. N. C. Morgan, cy. audt.

Ft. Strong (Boston P. O.), Mass.—Bids are asked until April 4 for constructing roads, walks and drains. Capt. A. H. Miller, constr. Q. M.

Ft. Wayne, Ind.—Bids are asked until April 2 for grading, graveling or macadamizing county highways. John B. Wyss, chmn. bd. co. comrs.

Globe, Ariz.—Bids are asked until April 6 for constructing a highway between Roosevelt and this city. J. J. Riggs, secy. bd. control.

Mt. Carmel, Ill.—Bids are asked until April 4 for constructing 18,000 sq. yds. of brick paving in Cherry st. Guy W. Courter, cy. engr.

Petersburg, Ind.—Bids are asked until April 5 for constructing rock roads. Thos. J. English, chmn. co. comrs; Frank R. Bidderback, co. audt.

Aberdeen, Wash.—Bids are asked until April 6 for paving, constructing concrete walks, curbs and gutters in Market and K sts. P. F. Clark cy. clk.

Ft. Leavenworth, Kan.—Bids are asked until April 6 for constructing concrete walks, curbs and gutters. Capt. William D. Davis, constr. Q. M.

Mayville, N. D.—Bids are asked until April 4 for constructing various kinds of sidewalks during the ensuing year. W. E. Ighehart, cy. audt.

Aberdeen, Wash.—Bids are asked until April 11 for 25,000 sq. yds. of brick, creosoted wood block and concrete paving. Cy. engr. Washburn.

Grinnell, Ia.—Bids are asked until April 4 for constructing 4000 sq. yds. of vitrified brick paving and 3000 ft. of curbing in alleys in blocks 3, 4, 7 and 8.

Amsterdam, N. Y.—Bids are asked until April 5 for constructing 4500 sq. yds. of

brick paving in E. Main st. and 3600 sq. yds. in Spring st., April 5. F. E. Crane, cy. engr.

Ft. Dupont (Delaware City P. O.), Del. —Bids are asked until April 4 for constructing 1934 sq. yds. of macadam roads and 3777 sq. ft. of granolithic sidewalks. Constr. Q. M.

Moose Jaw, Sask.—Bids are asked until April 11 for constructing 33,300 sq. yds. of pavement, 13,500 lin. ft. combined curb and gutter, 116,500 sq. ft. concrete sidewalks. W. F. Heal, cy. clk.

Jonesboro, Ark.—Bids are asked until April 5 for constructing 23,000 sq. yds. of vitrified brick block paving, 10,000 lin. ft. curbing and 105,000 sq. ft. concrete walks. B. H. Berger, chmn. bd. impvt. of st. impvt. dist. No. 4.

Platteville, Wis.—Bids are asked until April 14 for constructing 6550 sq. yds. of brick paving in Main and 2nd sts., including 340 lin. ft. curb and gutter, 490 lin. ft. marginal curb, and 320 lin. ft. plain curb. P. D. Hendershott, cy clk.

CONTRACTS AWARDED.

Appleton, Wis.—The contract for paving Union st. with asphalt was awarded to J. F. Hill of Chicago.

Enid, Okla.—The contract for paving work was awarded to the Warner-Quinlan Co., for $107,000.

Orange, Tex.—The contract for constructing 5 ft. sidewalks and curbings was awarded to G. W. Price.

Springfield, Ill.—Henry Nelch & Son secured the contract for repaving Jefferson st., at 42c a sq. yd.

Dallas, Tex.—Special.—The Texas Bitulithic Co. was awarded a contract for 1193 sq. yds. of brick paving.

Flint, Mich.—A contract for paving Garland st. with asphalt block was awarded to the Asphalt Block Co., for $19,768.87.

Rochester, N. Y.—The Julius Friedrich Co. was awarded contracts for paving Laburiuna, Crescent and Alliance ave.

Norfolk, Va.—Special.—The Atlantic Bitulithic Co. was awarded a contract for 2600 sq. yds. of bitulithic paving.

Manitowoc, Wis.—The Schuette Cement Construction Co. was awarded a contract for brick paving for $100,000.

Muncie, Ind.—William Birch was awarded a contract for constructing brick paving in Kilgore ave., for $22,900.

Crawfordsville, Ind.—The contract for constructing 3 miles of the Thomson gravel road was awarded to John Johnson, for $9900.

Lynchburg, Va.—The contract for paving 9th, Commerce and 8th sts. was awarded, Mar. 8, to J. L. Ford & Co., for $33,300.

Los Angeles, Cal.—The contract for paving 43rd st. with asphalt was awarded to George R. Curtis, at 20c a lin. ft.

Charleston, S. C.—Special.—The contract for constructing 7200 sq. yds. of bitulithic paving was awarded to the Atlantic Bitulithic Co.

Norfolk, Va.—The contract for paving Granby st. with creosoted wood blocks was awarded to the U. S. Wood Preserving Co., for $46,715.

Vincennes, Ind.—Contracts for constructing 4 gravel roads were evenly divided, March 8, between Hugh O'Donnell and C. F. Wolfe.

Nashville, Tenn.—The contract for grading and macadamizing Vernon ave. was awarded, March 17, to J. E. Lesueur & Co., for $2985.

Buffalo, N. Y.—Henry P. Burgard was awarded the contract for improving Bailey ave. across the West Shore Railroad, for $78,217.45.

Rochester, N. Y.—The Rochester Vulcanite Pavement Co. was awarded a contract, March 9, for asphalt street paving repairs, for $41,520.

Faribault, Minn.—The contract for 2600 sq. yds. of brick and sandstone paving was awarded, March 18, to Fielding & Shepley, of St. Paul, for $54,000.

Peoria, Ill.—D. A. Myers was awarded a contract for paving N. Glendall ave. with brick in two sections, at $1805.50 and $3760.08 respectively.

Dothan, Ala. — The Graves - Matthew Paving Co., of Birmingham, was awarded a contract for 9 blocks of vitrified brick paving, for $50,000.

Flint, Mich.—J. F. Hill was awarded a contract for paving 3rd st. from Harrison to Avon sts., with Trinidad lake asphalt, for $18,377.88.

York, Pa.—The contract for constructing 2500 sq. yds. of cement paving for the Brillhart estate was awarded to the General Supply & Construction Co.

Pensacola, Fla.—The contract for constructing 535,000 sq. ft. of concrete walks was awarded to W. W. Hatch & Sons, of Goshen, Ind., at 9.49c a sq. ft.

Pittsburg, Pa.—The contract for 5200 sq. yds. of brick paving in Walnut st., Versailles twp., was awarded to Robt. Weir, Jr., of McKeesport, Pa., March 8, for $3000.

Spokane, Wash.—The Western Asphalt Paving Co. has been awarded contracts as follows: Asphalt paving, Broadway ave., $55,000; paving and walks, 3rd ave., $13,377.

Pensacola, Fla.—The contract for constructing 635,000 sq. ft. of concrete sidewalks was awarded, March 10, to W. W. Hatch & Sons Co., of Goshen, Ind., at 11c a sq. ft.

Marshalltown, Ia.—The contract for constructing sidewalks, curbing and paving was awarded to Charles R. Speers. Concrete and tarvia are being considered for paving material.

Lexington, Ky.—The contract for reconstructing the asphalt paving in S. Ashland ave. from Main to High sts., was awarded to Carey & Reed, of Philadelphia, at $2.15 a sq. yd.

Norfolk, Va.—The contract for paving Chapel st. with 3½ miles of creosoted wood blocks was awarded, March 5, to the U. S. Wood Preserving Co., at $2.65 a sq. yd., or $5,167.50.

Lincoln, Ill.—The contract for brick street paving was awarded to A. D. Thompson, of Peoria, March 21, as follows: Kickapoo st., $21,266.18; S. McLean and Clinton sts., $7,229.01.

Carmi, Ill.—The contract for street paving was awarded to A. W. Eisemayer, of Granite City, at $1.64 a sq. yd.; setting 15,330 lin. ft. curbing, 56c a lin. ft.

Waterloo, Ia.—The contract for paving Arigona st. was awarded to the Bryant-Ford-McLaughlin Asphalt Paving Co., as follows: Asphalt, $1.90 a sq. yd.; combined curb and gutter, 60c a lin. ft.

Spokane, Wash.—The Independent Asphalt Paving Co. was awarded a contract for paving 5th ave., as follows: Asphalt paving and sidewalks, $11,800; maintenance of same, $545; paving alley, $4100; maintenance, $184.

Portland, Ore.—Special.—The contract for constructing 8400 sq. yds. of bitulithic paving was awarded to the Hebe Construction Co. Warren Bros. secured the contract for 44,125 sq yds. of bitulithic paving.

Hartford City, Ind.—Contracts for constructing the Hiatt-Willman and the Chapman macadam roads were awarded, March 7, as follows: Hiatt-Willman road, Clamme Bros., $12,475; Chapman road, William Grady, of Jay county, $7490.

St. Paul, Minn.—The contract for macadamizing Bald Eagle ave. was awarded

March 21 to P. J. Ryan, for $3548. J. J. Mergens was awarded a contract for grading and macadamizing Lexington ave., for $14,680, and the Centerville road, for $9760.

Bloomington, Ill.—The contract for paving Grove st. and Fairview ave. with brick was awarded, March 21, to I. D. Lain, as follows: Danville block, $1.60 a sq. yd.; combined curb and gutter, 40c a lin. ft.; c. I. sewer inlets, $10 each; 12-in. pipe inlets, 40c a lin. ft.; manholes, $24 each.

Mason City, Ia.—Special.—F. P. Wilson, cy. engr., says a contract was awarded to George Gabler, of this city, March 7, for 26,000 sq. yds. of cement concrete paving, at $1.25 a sq. yd.; 10,000 sq. yds. of brick block paving, at $1.90 a sq. yd.; 14,000 lin. ft. cement curbing at 40c a lin. ft.

Portland, Ore.—Bids were submitted March 17 for hard-surface pavements, including asphalt, bitulithic and Hassam, and contracts have been recommended for award as follows: Barber Asphalt Paving Co., 4th and 16th st., $1.80, and Montgomery st., $1.60 a sq. yd.; National Contract Co., 4th st., stone blocks, $20,000.

Green Bay, Wis.—The contract for constructing asphalt paving in Walnut, Dosman, Adams and other streets was awarded to J. F. Hill, of Chicago, March 10. The contract for paving 14 streets with tar macadam and concrete was awarded to the McGrath Construction Co., of this city. W. W. Hatch & Son, of Wabash, secured the contract for brick paving.

Grand Forks, N. D.—Contracts for paving were awarded, March 19, as follows: Dist. No. 11, 38,000 sq. yds. of Donnellite, P. R. McDonnell, $81,000; No. 12, 20,000 sq. yds. of bitulithic, Bitulithic Paving Co., $73,355.50; No. 13, 19,300 sq. yds. of granitoid, R. S. Blome Co., $51,792; No. 14, 8700 sq. yds. of creosoted wood block, Fielding & Shepley, $24,895.

Louisville, Ky.—Bids were submitted March 15 for reconstructing 14 streets with vitrified brick. The bids of Henry Bickel ranged from $1.90 to $1.95 for Rubles block; Staebler Co., Portsmouth granite, $1.87 to $2.05; G. W. Gosnell, Carlisle brick, vitrified brick, $1.85; L. R. Figg & Co., Carlisle block, $1.85. The contract has not yet been awarded.

Louisville, Ky.—Paving contracts were awarded, March 6, as follows: 7th and Magazine sts., vitrified brick, L. R. Figg & Co.; Marshall and Walnut sts., vitrified brick, J. W. Gosnell & Co.; granitoid sidewalks, Lee R. Figg & Co., G. W. Younger & Co., G. W. Gosnell, and the American Concrete Construction Co., at prices ranging from 90c to $1.20 a sq. yd. The prices for vitrified brick paving varied from $1.80 to $1.90 a sq. yd.

Minneapolis, Minn.—Contracts for paving to be constructed during 1910 have been awarded, aggregating $542,288, as follows: Northwestern Lime Co., 40,000 lbs. Portland cement, $1.10 a barrel; granite curbing, Northwestern Granite Co., 65c and 75c a ft.; sandstone curbing, Kettle River Quarries Co.; crushed granite, Western Granite Co., $1.98 a sq. yd.; creosoted wood paving blocks, Republic Creosoting Co., $1.32½ a sq. yd.; vitrified paving blocks, Purington Paving Block Co., 99.8c a sq. yd.; sandstone paving blocks, Kettle River Quarries Co., $1.54 a sq. yd.

Toledo, O.—Paving contracts were awarded, March 7, as follows: Garrigan Bros., Michigan st., Carbovia with concrete foundation and Berea curb, $6,007; grading and macadamizing Cincinnati st. with Carbovia, concrete base and Berea curbing, $4292; Walters & Tansey, repairing City Park ave., vitrified paving block on concrete, Berea curb and asphalt filler, $7565; Columbus st., vitrified paving blocks on concrete, sand filler and Berea curb, $4867; Joseph W. McMahon, grading Ohio st., $650; Ohio Paving Co., repaving Buckeye st. with vitrified paving blocks, concrete foundation, asphalt filler, and Berea curb, $4507.

SEWERS.

CONTEMPLATED WORK.

Akron, O.—The construction of a sewage disposal plant is contemplated.

East Rochester, N. Y.—Voted to appropriate $3,000 for sewer extensions.

Butler, S. D.—The construction of a sewerage system is contemplated.

Brush, Colo.—A sewerage system is contemplated. Mayor Wm. Smith.

Herington, Kas.—Council voted to construct a sewerage system.

Great Falls, Mont.—Council voted to construct sewers to cost $7,645.

Roundup, Mont.—Will vote on the issue of bonds for installing a sewerage system.

DeKalb, Ill.—Plans are being prepared for sewer extensions. A. R. Russel, cy. engr.

Princeton, Ind.—Plans for a sewerage system will be made by Henry Nickamp, cy. engr.

Morristown, Tenn.—Charles E. Collins, of Philadelphia, Pa., has been engaged as engineer for the sewerage system.

Tacoma, Wash.—Will vote soon on the issue of $100,000 bonds for storm sewers. W. C. Raleigh, cy. engr.

Forest Grove, Ore.—Preliminary surveys for a sewerage system are being made by city engr. Richardson.

Albion, Mich.—The construction of sewers is contemplated. J. J. Wiselogel, supt. bd. pub wks.

Tipton, Ind.—This city contemplates constructing a sewer in an alley. Robt. Van Buskirk, cy. engr.

Westport, Conn.—The fire district appropriated March 10, $1,500 for the construction of a sewerage system.

Glenellyn, Ill.—Plans for a sewerage system and disposal plant have been completed, estimated cost, $100,000.

Binghamton, N. Y.—Preliminary steps are being taken preparatory to the construction of an intercepting sewer system.

Philadelphia, Pa.—Ordinances have been passed for constructing sewers in the 9th, 21st, 23d, 41st and 42d ward.

Albert Lea, Minn.—The construction of lateral sewers in the southern and western parts of this city is contemplated.

Chico, Cal.—Will vote on the issue of $35,000 bonds for constructing storm water sewers. B. F. Hudspeth, cy. clk.

Haddon Heights, N. J.—Plans are being prepared for a sewerage system to cost $53,000. F. P. Burkhart, boro clk.

McKeesport, Pa.—The financial committee has appropriated $4,000 for preparing plans for a new sewerage plant.

Columbia, S. C.—The Granby Colton Mills is having plans prepared for constructing 7,000 feet of sewers in Mill village.

Pocatello, Idaho—The construction of a sewerage system at a cost of $150,000 is contemplated. W. A. Samus, cy. engr.

Grinnell, Ia.—The estimated cost of constructing a sanitary sewer on the west side is $25,000. W. F. Beard, cy. engr.

Russellville, Ark.—The construction of a sanitary sewerage system, including a septic tank, is contemplated this season.

Whitefish, Mont.—An ordinance was passed, March 10, providing for the issue

of $10,000 bonds for constructing a sanitary sewer.

Kissimmee, Fla.—Voted to issue $43,000 bonds for constructing sewers and water works. Xavier A. Kramer, engr., Magnolia, Miss.

Paterson, N. J.—A resolution was passed, March 15, providing for the construction of a sewer, at a cost of $137,000. John J. Harder, cy. engr.

Russellville, Ark.—Plans for a sanitary sewerage system, including septic tank, have been prepared by the Fuller-Coult Co., of St. Louis.

Leavenworth, Kas.—Plans have been approved for constructing a trunk sewer in district 9 in the southwestern part of the city. Estimated cost, $21,000.

Bridgeport, Ill.—Plans have been completed and bids will be asked in May for constructing a sanitary sewer. Judge Madeling, chm. bd. local impvts.

Watertown, N. Y.—Will vote in May on the issue of bonds for improvements to include a sanitary sewer in the first ward. E. W. Sayles, cy. engr.

Michigan City, Ind.—The bd. of pub. wks. has ordered the construction of the Willard ave. or prison district sewer, which will be 5,200 feet long and cost $40,000.

Vincennes, Ind.—Hering & Fuller, of N. Y. City, have been engaged to furnish plans for the proposed system of storm and sanitary sewerage, at a cost of $2,500.

Oroville, Cal.—A preliminary report has been submitted to the city council for the proposed sewerage system. Estimated cost, $120,000. B. L. McCoy, cy. engr.

San Francisco, Cal.—An ordinance was passed March 7 providing for the construction of sewers in section D, of the Yerba Buena district, at a cost of $220,000.

Montgomery, Ala.—The Western R. R. of Alabama will construct a concrete sewer and reservoir in N. Court st., at a cost of $10,000. W. N. Cox, supt., Montgomery.

Geneva, N. Y.—Wm. S. Johnson, Boston, has been engaged to act as consulting engineer in the work of planning an investigation of the sewer and water systems. C. T. Church, cy. engr.

Phenix City (Columbus, Ga., P. O.), Ala.—This city will construct 600 feet of sewer pipe across the street at the foot of Summerville hill, and fill in the street. Wiley Rusk, chm. st. com.

Sheboygan, Wis.—The bd. of pub. wks. has recommended the construction of an intercepting sewer from Michigan ave. to the Sheboygan river along Franklin ave., and N. 5th street, to be built this year.

Oswego, N. Y.—L. C. Rowe, Merrick Stowell, Wilson Skinner, Thos. H. King, R. A. Downey and V. J. Maloney have been appointed a commission to investigate the sewer conditions and recommend plans for the necessary improvements.

Pleasant Ridge, O. (Special)—The city council accepted and adopted, March 16, the surveys, maps, plants, designs and estimates of Donald W. Caven, C. E., and surveyor, for a sewerage system and disposal plant including about 15 miles of vitrified pipe sewers, and costing approximately $227,000.

CONTRACTS TO BE LET.

Big Stone Gap, Va.—Bids are asked until April 15 for constructing sewer work. Cy. recdr.

Manhattan, Kas.—Bids are asked until May 3 for constructing a sanitary sewer. C. M. Buck, cy. engr.

Upper Alton, Ill.—Bids will be asked about May 1 for constructing sewers. M. A. Greding, cy. clk.

Ashley, N. D.—Bids are asked until April 4 for furnishing 12 metal culverts. John F. George, co. audit.

Enid, Okla.—Bids are asked until April 21 for constructing a lateral sewer in Garland addition. E. R. Lee, cy. clk.

Fargo, N. D.—Bids are asked until April 28 for constructing a 12 in. lateral sewer in 13th st. N. C. Morgan, cy. audit.

Telluride, Colo.—Bids are asked until April 15 for constructing a sewer system in West Telluride. Jas. S. James, cy. engr.

Indianola, Ia.—Bids are asked until 7 p. m., April 4 for constructing a settling tank and outfall sewers. J. H. Clarke, cy. clk.

North Battleford, Sask.—Bids are asked until April 19 for constructing sewers and sewage disposal works. J. A. Foley, mayor.

Newport, Ark.—Bids are asked until April 27 for constructing 6½ miles of sanitary sewers and a pumping plant. C. S. Henry, secy.

Nevada, Ia.—Bids are asked until April 5 for constructing the Washington-Palestine twp. drainage dist. No. 28. F. G. Dunahugh, co. audt.

Brooklyn, N. Y.—Bids are asked until April 6 for constructing sewers and sewer basins in various streets. Alfred Steers, boro prest.

Toronto, Ont.—Bids are asked until April 19 for constructing section No. 1 high level intercepter. G. R. Grary, mayor and chm. bd. control.

Danville, Ill.—Bids are asked until May 1 for constructing sewers in Fairweight Park and Elmwood Park additions. W. E. Winn, cy. engr.

Comstock, N. Y.—Bids are asked until April 5 for constructing a sewage disposal system. C. V. Collins, supt. State Prisons, Capitol, Albany, N. Y.

Trenton, N. J.—Bids are asked until April 5 for constructing sewers in Styvesant, E. Stuyvesant and Exton aves., Prospect and Marion sts. Harry B. Salter, cy. clk.

Columbia, Mo.—Bids are asked until April 5 for constructing 16,000 ft. of 8 to 12 in. sewers for tile and earthen-ware and 55 manholes. John S. Bicknell, cy. clk.

San Antonio, Tex.—Bids are asked until April 5 for constructing 11 miles of sanitary sewers, including manholes and flushtanks in impvt. dist. No. 7. Bryan Callaghan, mayor.

Louisville, Ky.—Bids are asked until April 8 for constructing 5,198 ft. of concrete sewer in Brook st., requiring 5,000 cu. yds. concrete and 495,000 lbs. steel. Comrs. sewerage.

Charleston, S. C.—Bids are asked until April 5 for furnishing iron castings, Portland and Rosendale cements, terra-cotta glazed pipe, bluestone, granite or gneiss curb, etc. B. P. W.

Canton, Ill.—Bids are asked until April 14 for constructing a system of storm water sewers, changes and additions to sanitary sewer and sewage purification tanks, etc. Joseph Waugh, cy. clk.

Arnold, Pa.—Bids are asked until April 6 by Arnold and New Kensington boroughs for constructing a 48 in. steel reinforced concrete sewer, 2,000 ft. in length in 14th st. George B. Campbell, Jr., boro engr.

Toronto, Ont.—Bids are asked until April 4 for constructing a pipe sewer and appurtenances for the Victoria Industrial School, Mimico. Chester Ferris, supt. Victoria Industrial School, Mimico.

Peabody, Kas.—Bids are asked until April 5 for constructing 4 miles of 8 to 12 in. sanitary sewers, with manholes, lampholes, flushtanks, etc., and a reinforced concrete septic tank. J. W. Mavity, engr.

Newark, N. J.—Bids are asked until April 5 for constructing a storm water drainage system in Park ave., including 10,400 ft. 8 to 24 in. vit. pipe; 1,700 ft. 24, 27 and 30 in. reinforced concrete pipe; 130 reinforced concrete catch basins; 150 cu. yds. brick masonry; 25,000 lbs. c. i.; 1,000 lbs. wrought iron. A Church, comr. Essex Co., park comrs.

CONTRACTS AWARDED.

Mayfield, Cal.—The contract for sewer construction was awarded to J. Birkett & Sonnicken.

Dayton, O.—The contract for constructing the Haynes st. sewer was awarded Hecker & Kirschner, for $6,701.

Omaha, Neb.—James Jensen was awarded a contract for building a brick and concrete sewer in Burt, for $46,968.20.

Canby, Minn.—The contract for constructing a sewerage system was awarded to Tanner Bros., of Webster, S. D., for $24,384.

Pine Bluff, Ark.—The contract for extending the sewers in Mulberry st., 18th, 19th and 20th aves., was awarded to Robinson Bros.

Clinton, Okla.—The contract for constructing pipe sewers was awarded to the the Heman Constr. Co., of St. Louis, Mo., for $17,838.

Plymouth, Wis.—The contract for sewer construction was awarded to Eul, Cochems & Nebel, of Sturgeon Bay, Wis., for $16,065.

Charleston, S. C.—The contract for additional drain trunk at the Navy Yard was awarded to P. D. Hay, of this city, for $29,000.

Medina, N. Y.—The contract for constructing the west side sewerage system was awarded to the F. J. Gotts Co., of Hambery, for $27,750.

Lodi, Cal.—The contract for constructing a sewerage system was awarded Mar. 16 to J. M. Appleton and Frederickson Bros., for $51,226.

Holton, Kas.—The contract for construcing a sewerage system was awarded to P. A. Johnson & Co., of Kansas City, Mo., for $45,204.39.

Gurley, Colo.—The contract for sewer work in dist. 45 was awarded, March 8, to Spicer & Watson, of Colorado Springs, for $18,659.

Portland, Ore.—The contract for constructing the Brooklyn sewers was awarded, Mar. 11, to Pacquet, Girbisch & Joplin, for $247,000.

Metropolis, Ill.—The contract for constructing a sewerage system was awarded to Reeb Bros., of Belleville, Ill., Mar. 7, for $57,659.

New Britain, Conn.—The contract for furnishing sewer pipe for the fiscal year was awarded to the Warner-Miller Co., of New Haven, for about $15,000.

Franklin, Tenn.—The contract for extending the sewerage and water wks. systems was awarded, Mar. 17, to the Sheffield C. I. Pipe & Foundry Co.

Sterling, Ky.—The contract for constructing a sewerage system was awarded to the Clark County Constr. Co., of Winchester, Ky., for $41,000.

Parkersburg, W. Va.—John W. Curry was awarded a contract, Mar. 9, for constructing a sewer in 22d, 23d and other streets in the 7th ward, for $6,201.95.

Greenfield, Ind.—The contract for constructing a sewer system and light plant for the County Infirmary was awarded to the Clark Lighting Co., and J. W. Fry.

Springfield, Ill.—Robt. E. Goodwin was awarded a contract for constructing a sewer in N. 9th st. at 36 cts. a ft. for the main sewer, 34 cts. for inlets, and $25 each for manholes.

Kansas City, Mo.—The contract for constructing a reinforced concrete pipe joint district sewer in Burch Creek Watershed was awarded, Mar. 18, to Williams & Sample, of this city, for $250,580.

Salt Lake City, Utah.—(Special). The contract for constructing a reinforced concrete conduit in Parley's Creek, south of 12th South st., was awarded to the Moran Construction Co., for $6,085.98.

Rice Lake, Wis.—Bids for constructing a 44 in. concrete sewer and vitrified pipe sewers, with Aylward c. i catch basins and concrete basins were submitted as follows: E. Knudson, Rice Lake, $50,450 and $57,170; E. N. Harding Co., $58,138 and $58,738; Pastoret & Lawrence Co., $58,884 and $60,304.

Muscatine, Ia.—Contracts were awarded, Mar. 10, as follows: For Keckerville sewer to the Independent Construction Co., of Davenport, Iowa, at $5,873; for Fair Oaks sewer, to the Eppel-Schlosser Co., of Muscatine, at $3,398. James J. Ryan is city engineer.

Monticello, N. Y.—C. S. Lambie & Co., of Pittsburg, Pa., secured the contract, Mar. 17, for constructing a portion of the sewerage system and a garbage disposal plant, for $92,900. The other bids submitted were as follows: L. F. Bannon, Kingston, $116,092; T. C. Rider Co., Monticello, $98,000; John W. Heller, Newark, N. J., $98,712; Albert W. Banker, Gloversville, $114,000; Kellam & Shaffer, Schenectady, $122,600; John B. O'Roarke, Boston, $112,113; Delaware Constr. Co., Sydney, $116,000; Albert Gaffey, Syracuse, $116,771; Chas. Ippolito, Orange, N. J., $100,320.

WATER WORKS.

Bessemer, Ala.—The city council passed an ordinance, Mar. 10, to purchase the city waterworks for $500,000. Mayor Lewis.

CONTEMPLATED WORK.

Elyria, O.—The extension of the water services is contemplated.

Medford, Okla.—Voted to issue bonds for the extension of the water works.

Lordsburg, Cal.—The construction of a water works plant is contemplated.

Harbor Springs, Mich.—Voted to install a waterworks system.

Ft. Erie, N. Y.—Voted to construct a municipal waterworks system.

Ephraim, Utah.—The construction of a water works system is contemplated.

Walthill, Neb.—The construction of a water works system is contemplated.

Lafayette, Ala.—The installation of a waterworks system is contemplated.

McKeesport, Pa.—The finance committee has appropriated $20,000 for new water mains.

Grinnell, Ia.—The estimated cost of 40 blocks of water mains in West Grinnell is $12,000.

Libby, Mont.—Council is considering the question of a municipal waterworks system.

Butler, Pa.—The Butler Water Co. is considering the construction of a reservoir.

Mitchell, Ind.—The question of granting a water works franchise is under discussion.

Houma, La.—The bd. of aldermen has authorized Calvin Wurzlow, mayor, to ask for bids for a pump.

Fenton, Ia.—Voted to issue bonds for constructing a water works system. T. M. Hillsborough, cy. clk.

Oconomowoc, Mo.—An ordinance has been passed for constructing and extending the water works system.

Lafayette, Ala.—Voted to issue bonds for constructing a water works and electric light plant.

Hamilton, Ont.—The construction of new water mains is contemplated. A. H. McCaullum, cy. engr. and mgr. w. w.

Miles City, Mont.—Will vote on enlarging and improving the water works, electric light, and sewer system.

Elberton, Ga.—Additional filter capacity at the water works plant is comtemplated. G. W. Hubbard, supt.

Mart, Tex.—The Commercial Club is considering the construction of a dam to furnish the city with supply of water.

Tulsa, Okla.—Voted $100,000 bonds for improving, extending and maintaining the water works system. B. H. Sand, supt.

Hartford, Conn.—The bd. of water comrs. voted to construct water mains in Kenyon and Magnolia sts. and Shultas Place.

Gadsden, Ala.—J. N. Hazlehurst, of Atlanta, has been engaged as engineer for the proposed improvements to the water works.

Sacramento, Cal.—The East Sacramento Water Co. has adopted plans and specifications for the construction of a concrete tank.

Columbus Junction, Ia.—The business men are in favor of erecting a concrete dam across the Iowa river north of this city.

Bloomington, Ind.—The trustees of the Indiana University have approved plans for a new water plant, and bids will be asked soon.

Minneapolis, Minn.—The water committee has recommended the construction of water mains in numerous streets, at a cost of $400,000.

North East, Md.—Bids will be asked about May 1 for constructing a water works system. G. A. M. Johnson, Leslie, Md., prest. company.

Gainesville, Tex.—The city council voted in favor of the city purchasing the Gainesville water works system for $92,000, and operating it.

Trenton, N. J.—Hering & Fuller, N. Y. City, will make preliminary investigations with a view to constructing a water purification plant.

Defiance, O.—Preliminary plans for a municipal water works system and electric light plant will be made. Chas Behringer, dir. dept. P. S.

Searcy, Ark.—W. S. Shields, cons. engr. of Chicago, estimates the cost of making improvements in water and sewer district No. 1 at $81,000.

Galesburg, Ill.—An ordinance has been referred to the finance committee providing for the issue of $75,000 for the improvement of the water systems.

Duluth, Minn.—The water and light bd. has been authorized to sell $200,000 bonds for extensions and improvements in the water and gas systems.

Boonville, Ind.—Resolutions have been passed ordering the construction of a new city reservoir back of the present lake. Louis Meyer, cy. engr.

Parkersburg, W. Va.—This city will construct a reservoir, pumping station, and pumping engines. The date for receiving bids has not yet been decided upon. Frank Good, cy. audt.

Olathe, Kas.—(Special). L. R. Sykes, cy. clk., says this city will probably vote April 5 on the proposition to erect a standpipe and filter for the waterworks system.

Anoka, Minn.—Will vote April 10 on the issue of $45,000 bonds for constructing a power dam on the Rum river, and for erecting and equipping sub-stations, pumps, transforming stations, etc.

Austin, Tex.—This city will vote April 5 on the proposition of the Dumont-Holmes Steel Concrete Co., of Chicago, to rebuild the dam across the Colorado river above this city, for $1,000,000.

Peru, Ind.—Plans and specifications for installing new machinery and other changes in the water works and lighting systems will be prepared by Smith, Hinchman & Grylh, of Detroit, Mich. T. E. Dunn, cy. clk.

Childress, Tex.—John B. Hawley, of Ft. Worth Tex., has been engaged as engineer for water works improvements, including a pumping station at Lake Childress and laying 10,000 ft. of 8 in. water piping.

Potsdam, Ky.—(Special). Geo. A. Littel, supt. Potsdam w. w., says an appropriation was voted by this village recently for the purpose of investigating the building of a standpipe. Correspondence is solicited.

Toronto, Ont.—The city engineer has been directed to report on the practicability and cost of extending the intake pipe 1,000 ft. further out in the lake and sink it 100 ft. below the surface.

Gilbert, Minn.—C. L. Newberry, Jas. Darling, and O. H. Haenke have been appointed a water, light and power commission to consider the question of installing sewer, waterworks and lighting systems.

Medina, N. Y.—At a joint meeting of the bd. of trustees and the board of water comrs., March 21, it was decided to retain as an auxiliary water supply that part of the old Knowlesville Waterworks plant south of the canal.

Minneapolis, Minn.—Rudolph Hering, of N. Y. City, recommends rapid mechanical filtration of the Mississippi river water, as a means of solving the question of fine water for the city. He estimates the initial cost of the plant at $552,500.

Hillsboro, Ore.—(Special). A. G. Gilmore, supt. Hillsboro Water, Light & Power Co., says this city contemplates sinking additional wells for the public water supply, and would appreciate any information they receive regarding pumping machinery, methods of sinking wells, etc.

Denver, Colo.—This city will vote, May 17, on the propositions, as follows: 1 new, 20 yr. franchise of the Denver Union Water Co., in exchange for which the company will give the city $100,000 bonus a year in fire service. 2. Proposition to issue $17,500,000 bonds for the purchase of the water plant and its improvements either by the city or the united commercial organizations.

Anita, Ia.—(Special). Bruce & Ziegler, attorneys-at-law, advise us that the business men of this city have recently organized a commercial club, which is now investigating the question of a municipal waterworks and light plant. The town has a population of 1,500. It has not water power, and will secure its water from wells. Both plants will have to be run by gasoline or steam engines. Bruce & Ziegler desire names and addresses of parties interested in installing such plants.

CONTRACTS TO BE LET.

Benoit, Miss.—Bids are asked until

April 5 for constructing a waterworks system. M. M. Thompson, mayor.

Quitman, Ga.—Bids are asked until April 6 for constructing a steel tower and tank. J. D. Wilson, mayor.

Florence, S. C.—Bids are asked until April 15 for constructing 7 miles of water mains. M. D. Lucas, cy. secy. and treas.

Madison, Neb.—Bids are asked until April 6 for a motor driven pump, steam boiler, etc. F. J. Danken, cy. clk.

North Battleford, Sask.—Bids are asked until April 19 for constructing water works, concrete reservoir, etc. J. A. Foley, mayor.

Waterbury, Conn.—Bids are asked until May 17 for constructing a new concrete dam in the town of Morris. R. A. Cairns, cy. engr.

Ft. Hancock, N. J.—Bids are asked until April 21 for laying a submarine line of 2,200 ft. of 10 in. universal c. i. pipe. Marietta Water Co.

Cokeville, Wyo.—Bids are asked until April 15 for constructing the Covey Canal, near here. W. Newborough, ch. engr., Evanston, Wyo.

Opelika, Ala.—Bids are asked until April 15 for furnishing water to city service to begin at expiration of present contract. L. F. Rickson, mayor.

Ft. Collins, Colo.—Bids are asked until April 14 for constructing a storage reservoir on Bingham Hill, 6 miles from here. Ross S. Fedder, cy. clk.

Columbus, O.—Bids are asked until April 4 for furnishing 700 tons of c. i. pipe and 25 tons of special castings. H. S. Holton, dir. pub. service.

Meridian, Miss.—Bids are asked until April 5 for constructing 8,500 ft. of 24 in. reinforced concrete conduits. Wm. F. Wilcox, gen'l mgr. water comm.

Ft. Bayard, N. Mex.—Bids are asked until April 18 for constructing the post water main, with installation of fire plug. Capt. S. D. Vestal, Constr. Q. M.

Weston, Ont.—Bids are asked until April 18 for constructing a pump house, mechanical water filters, and electricity operated machinery. T. H. Taylor, clk.

Russellville, Ark.—Bids will be received about June 1 for constructing the proposed water works system. A. B. Brewster, prest. Russellville Water & Light Co.

Madison, Wis.—Bids are asked until April 5 for completing the water mains in the Capitol park and grounds of the Capitol Heat, Light & Power plant, Lew F. Porter, secy. Capitol Comn.

Ft. Collins, Colo.—Bids are asked until April 14 for constructing a reservoir on Bingham Hill with concrete sides and bottom and concrete or frame roof. Robt. S. Fielder, cy. clk.

Detroit, Minn.—Bids are asked until April 4 for constructing 8,560 ft. of 6 in. and 300 ft. of 8 in. water mains; 21 hydrants; 11 gate valves; 4,000 lbs. special castings. Chas. G. Sturtevant, cy clk.

Theodore, Utah.—Bids are asked until April 9 for constructing main irrigating canal from Rock Creek to eastern edge of Blue Bench, 13.56 miles. Jackman Herrick, secy. Upper Blue Bench Irrigation dist.

Newton, Mass.—Bids are asked until April 6 for constructing a pressure tunnel and laying water mains, etc., for the western aqueduct supply main. Henry H. Sprague, chm. Metropolitan water and sewer bd.

Corpus Christi, Tex.—Bids are asked until April 8 for furnishing 4, 6 and 8 in. c. i. water main and c. i. specials, gate valves, hydrants, etc., and for laying 8 miles of water mains. Clark Pease, mayor.

Weyburn, Sask.—Bids are asked until April 27 for constructing power house, mechanical water filters, water works pumping machinery, constructing sewer pipe, sewage disposal works, etc. Geo. Ross, secy.-treas.

Calgary, Alta.—Bids are asked until May 1 for completing the canal system in the eastern section of the company's irrigation block in Alberta. J. S. Dennis, asst. to 2d vice-prest., Canadian Pacific Ry. Co.

CONTRACTS AWARDED.

Salt Lake City, Utah.—(Special). The contract for constructing water mains was awarded to P. J. Moran, for $49,438.60.

Townsend, Wash.—The contract for constructing reservoir No. 2 on Morgan Hill was awarded to Coyne & Son, for $12,482.

Tacoma, Wash.—The contract for laying water mains in Canal, River and 21st sts. was awarded to Bertelson & Sons, for $23,800.

Milwaukee, Wis.—The contract for constructing 4 to 16 miles water mains during the coming year was awarded to Michael O'Donnell, for $15,000.

Baltimore, Md.—The contract for constructing pipe lines throughout Ten Hills, suburban development, was awarded to the Baltimore County Water & Electric Co.

Atlantic City, N. J.—The Heine Safety Boiler Co., of Philadelphia, was awarded the contract for furnishing and installing two boilers at the Absecon pumping station, for $6,466.

Meadville, Pa.—The contract for erecting a brick chimney at the city pumping station was awarded, March 7, to the Heine Chimney Co., of Chicago, for $1,342, without foundation.

Portland, Ore.—The Schaw Batcher Works, of Sacramento, received the contract, March 8, for constructing a steel conduit from the headworks to Mt. Tabor, a distance of 24 miles, for $1,259,782.

Canon City, Colo.—The contract for constructing a complete system of irrigation for the Southern Irrigation Co. was awarded to the Kenefick-Quigley-Hoffman Constr. Co., of Denver, Colo., for $12,000,000.

BRIDGES.

Meadville, Pa.—Plans are being prepared for a bridge over French creek at Mead ave.

Vincennes, Ind.—Bids are asked until April 5 for bridge repairs. John T. Scott, co. audt.

Coffeyville, Kas.—Bids are asked until April 12 for constructing several bridges. Bd. co. comrs.

Noblesville, Ind.—Bids are asked until April 5 for constructing 7 concrete bridges. Geo. Guffin, co. audt.

Decatur, Ind.—Bids are asked until April 4 for constructing a number of bridges. H. S. Michaud, co. audt.

Piedmont, Cal.—The citizens voted to issue $35,000 bonds for constructing a concrete viaduct on Oakland ave.

Goshen, Ind.—Bids are asked until April 5 for constructing bridge and repairs. D. O. Batchelor, co. audt.

Streator, Ill.—Bids are asked until April 4 for building a bridge over the river. John B. Patterson, cy. clk.

Danville, Ill.—Bids are asked until April 4 for constructing a concrete reinforced and steel highway bridge. Co. comrs.

Salem, Ind.—Bids are asked until April

4 for constructing a concrete bridge over Blue river. Sam G. Ellis, co. audt.

Kalama, Wash.—Bids are asked until April 5 for building a steel highway bridge at Castlerock. G. S. Roberts, co. engr.

Elizabeth City, N. C.—Bids will be asked soon for constructing a new bridge across the Pasquotauk river. Camden Ferry Co.

LaPorte, Ind—Bids are asked until April 4, for constructing a bridge over Kankakee river at English lake. C. H. Miller, co. audt.

Lynchburg, Va.—H. L. Shaner, cy. engr., will prepare plans and specifications for constructing a reinforced concrete bridge across James river.

Gretna, La.—Bids are asked until June 1 for building a steel bridge across Harvey Canal in Jefferson Parish. E. M. Hubert, secy. Police Jury.

Shreveport, La.—Bids are asked until April 12 (extension of date), for building a steel traffic bridge over Red river. Geo. R. Wilson, cy. engr.

White Rocks, Utah.—Bids are asked until June 1 for building a steel bridge at Uintah and Ouray Indian agency. Comr. Indian Affairs, Wash., D. C.

Bridgeport, Conn.—Plans for a reinforced concrete bridge over Rooster river on Brooklawn ave., have been prepared by M. F. McKenna, cy. engr.

Bryan, O.—Bids are asked until April 4 for constructing several reinforced concrete sub and superstructures for bridges. R. H. Weaver, co. audt.

Troy, O.—The construction of 3 lift bridges over the Miami and Erie Canal, and 3 bridges over Miami river is contemplated. H. E. Whitlock, co. surveyor.

San Jose, Cal.—Bids are asked until April 5 for constructing a reinforced concrete bridge across Coyote river. Henry A. Pfister, clk. bd. supvrs.

Harrisville, W. Va.—Bids are asked until April 4 for constructing a steel bridge across the north fork of Hughes river, Clay dist. W. R. Meservie, clk. co. comt.

Manhattan, Kas.—Bids are asked until April 7 for constructing a stone arch bridge across School Branch, and a 60 ft. bridge across Deep Creek. Geo. H. Hungerford, co. clk.

STREET LIGHTING.

Allerton, Ia.—Voted to issue bonds for constructing an electric light plant.

Jefferson, Wis.—Will vote April 8 on the question of purchasing a water power site.

Madisonville, Tex.—Plans are under way for constructing an electric light plant here.

Clifton Springs, N. Y.—Voted to issue bonds for enlarging the municipal electric light plant.

Stafford, Kas.—Voted to issue bonds for constructing an electric light and water works system.

Opelika, Ala.—Bids are asked until April 15 for furnishing electricity to city. L. F. Dickson, mayor.

Belton, Tex.—The city council has granted W. F. Thornton a franchise for an electric light plant, for $30,000.

Brownsville, Tex.—Voted to issue bonds for improvements and extensions to the local electric light and power plant.

Hayward, Cal.—Bids are asked until April 6 for the purchase of electric light and power franchise. Bd. city trustees.

Ft. Sill, Okla.—Bids are asked until April 13 for constructing an electric light and power plant and lighting here. Capt. David L. Stone, Q. M.

Camrose, Alberta.—Bids are asked until April 15 for installing an electric light and power plant on 10 yr. franchise. O. B. Olson, cy. secy.-treas.

Albany, N. Y.—Bids are asked until April 7 for constructing 4 hydroelectric power plants on canals, and for lighting 8 locks on 3 three canals. F. C. Stevens, supt. pub. wks.

Otisville, N. Y.—Bids are asked until April 12 for installing an electric light and power plant at Tuberculosis Sanitorium. Ernest J. Lederle, Ph. D., prest. bd. health of N. Y.

Seymour, Ind.—Bids are asked until 12 m., April 21, for electric street lighting and franchise for commercial lighting, requiring 19 arc and 525 tungsten incandescent lights. McMean & Tripp, engrs., Majestic Bldg., Indianapolis.

Rumford, Me.—Bids are asked until April 14 for ledge excavation and masonry cradles for 1,000 ft. of 14 ft. penstock, relief pipe and concrete spillway; machine and building excavation and concrete foundations, brick and concrete station building, etc.; 4,000 cu. yds. ledge excavation; 500 cu. yds. rubble masonry; 120 cu. yds. concrete; 112 cu. yds. brick work. Rumford Falls Power Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Evansville, Ind.—Bids are asked until April 8 for sprinkling 25 streets. B. P. W.

Huron, S. D.—A committee has been appointed to procure a site and install a garbage crematory.

West Point, N. Y.—Bids are asked until April 15 for constructing a garbage crematory. Q. M.

Atlanta, Ga.—Bids are asked until April 29 for constructing a garbage crematory. G. H. Brandon, secy. bd. of health.

Pittsfield, Mass.—The contract for collecting garbage was awarded to John Bros., of Peak's Road, for $79,500, for 5 years.

Boston, Mass.—Bids are asked until May 15 for furnishing watering carts and watering and oiling streets in 10 districts, and for cleaning streets and sidewalks in 4 districts. Guy C. Emercon, supt. sts.

PARKS.

New Rochelle, N. Y.—The question of a public park is still urged.

Hamilton, O.—This city will vote April 16 on appropriating $400,000 for constructing a levee and parks.

New Brunswick, N. J.—The city council has authorized the purchase of a 28 acre tract of land for park purposes.

FIRE APPARATUS.

Clarington, O.—(Special). Col. S. Tachappat says this city needs something to fight fires with, as it has not a water works system.

Harrison, N. J.—Bids are asked until April 5 for furnishing 2,000 ft. of 2½ in. hose for the fire department. Peter Goodman, town clk.

Vancouver, B. C.—Bids are asked until April 21 for furnishing 2 automobile hose wagons, 2 chemical wagons and 1 aerial ladder. Wm. McQueen, cy. clk.

MUNICIPAL ENGINEERING

VOLUME XXXVIII. MAY, NINETEEN HUNDRED TEN. NUMBER FIVE

TOWN SCAVENGING AND REFUSE DISPOSAL.

TYPES OF DESTRUCTORS.

By Hugh S. Watson, A. M. I. C. E., London, England.

IN dealing with various types of refuse destructors it is very difficult to generalize, since all installations must differ very considerably, owing to their having to be designed to meet the particular requirements of each case. In the case of small towns having only a limited quantity of refuse to dispose of, the destructor might consist of merely a simple refuse burning installation, while in the case of a large town where considerable quantities of good refuse have to be dealt with daily, it might comprise many accessories to facilitate both the handling and the burning of the refuse, as well as the utilization of the heat generated. The forms of destructors also vary greatly, some being constructed on the isolated grate principle, and others on that of the continuous grate, by which is meant a series of furnaces each opening from one to the other, so that the hot gases are discharged from one fire over another on their way to the outlet. The method of charging will further modify the surroundings of a plant, while even more important considerations in this respect are the site, local conditions of working, the quality and quantity of the refuse to be burned, the amount of steam that can be used, and the purposes for which it is to be employed. Bearing these considerations in mind, the author has come to the conclusion that it is impossible to take any design as being "typical" of the plant manufactured by any individual maker and he has therefore decided to confine his remarks in each case to descriptions of modern plants which have been erected by the various manufacturers under certain definite conditions.

Speaking generally, the developments which have taken place in the design of destructor installations during the past few years have been on the lines of securing better conditions for the workmen in the destructor house, and higher temperatures in the destructors themselves. More efficient means of ventilation have been introduced, rendering it possible to keep the destructor building continuously supplied with fresh air, so that the nuisance arising from dust has been considerably diminished. Various improvements in construction have also been made to insure normal ruling conditions in the furnaces. These will be dealt with in detail.

HEENAN & FROUDE'S DESTRUCTOR.

Figure No. 1 illustrates a series of six front feed cells erected at Stoke Newington by Messrs. Heenan & Froude, Ltd., of Manchester. The plant consists of two units of three grates each; each grate has an area of 25 sq. ft., and there is a separate ash pit to each grate. At the end of each unit there is a large combustion chamber placed at right angles to the furnace, and at right angles to this chamber and parallel with the furnace are placed two Babcock & Wilcox water tube boilers, each with a heating surface of 1,741 sq. ft. At the end of the boilers are the air heaters, and the gases, after leaving these, pass directly into the main flue. The material is delivered on to a tipping platform, below which are placed two hoppers capable of holding about half a day's supply. The refuse is shoveled directly from the hoppers and is spread over the furnace grate in one operation. The forced draught is supplied from two fans driven by a small motor, and the air is heated before being delivered to the furnaces. There are also a Worthington pump and an injector for filling the boilers, as also a super-heater. The fans are also used to ventilate the destructor house. This is effected by means of an air duct

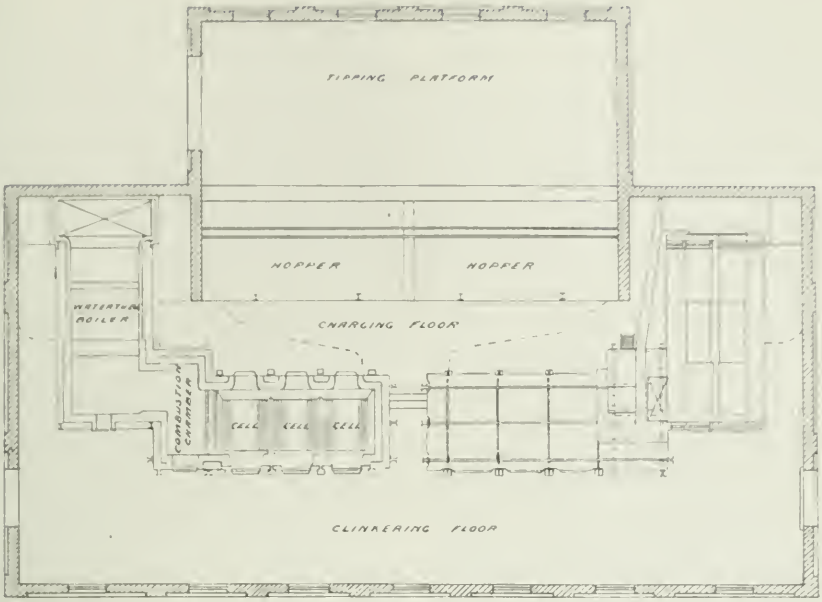
constructed in the roof, which communicates with the shaft supplying the air for forced draught for the furnaces. The air is drawn into the destructor house from all sides, and it is replaced five or six times in the hour. By this arrangement any objectionable odor which may arise when the refuse is being delivered is not distributed to the surrounding neighborhood, as is the case when the ventilation is from the inside to the outside. The cost of burning the refuse amounts to about 7.3d (15 cents) per ton, to which has to be added the cost of cleaning the flues at about 0.5d (1 cent) per ton, bringing the total cost to 7.8d (16 cents) per ton. The average quantity of refuse received at the destructor in the summer is thirty tons per day, and in winter forty-five tons per day. This is dealt with by two shifts of two men each, the number of hours worked by each shift being eight in summer and ten in winter.

MANLOVE, ALLIOT & CO.'S DESTRUCTOR.

A plant designed by Messrs. Manlove, Alliot & Co., Ltd., of Nottingham, for the metropolitan borough of Shoreditch comprises two sets of three Babcock & Wilcox water tube boilers, each having two refuse furnaces, one placed on either side of the boiler, while an ordinary coal fire grate immediately under the boiler tubes is provided as an auxiliary for use if required. A complete set thus consists of one boiler and two furnaces. As the area of the works was very limited, it was not found possible to construct an inclined roadway up which wagons loaded with refuse could be taken to be tipped directly on the top of the furnaces, and it was therefore decided to put in lifts to raise the refuse to the top platform. The refuse when received at the works is shot into one of two lifts, each provided with a tipping truck, which is run off the lift as soon as it reaches the top of the platform. The truck runs upon rails and is operated on the trolley system. The refuse is then taken into special charging trucks worked by chain gear, one of which is provided for each furnace. The average amount of refuse received per day is about 85 tons, and this is delivered between 9 a. m. and 5 p. m., but the amount varies considerably. In summer it may be as low as 60 tons, and in winter as high as 140 tons. As it is found impossible to get a supply at a regular rate, it was considered advisable to provide storage space to cope with extra large deliveries. For this purpose a large rectangular iron storage bin holding about 60 tons of refuse is fixed under the tipping platform. The lifts and tip trucks are worked entirely by electricity. Each furnace is provided with both a steam jet and a forced air blast. This is supplied by means of three Sturtevant fans, each designed to give 8,000 cubic feet of air per minute, and driven direct by a shunt-wound electric motor at a speed of 650 revolutions per minute. The inlets to the fans are connected with air ducts that draw the hot air from the top platform of the destructor. The three fans are connected to a common discharge duct which is led underground to the ash pits, the draught to each being controlled by a separate air valve. The boiler feed is furnished by a Weir pump, which forces the cold water through a Green economizer, where it is heated to a temperature varying with the load. The feed then passes into a thermal storage vessel fixed at a level of about 20 feet above the boilers. This vessel is simply a horizontal shell 30x8 feet, which is used for storing during the hours of light load, hot water with which the boilers are fed directly by gravity. Alongside the works are situated an electro-generating motor and public baths and wash houses which contain one swimming bath 100x40 feet, one swimming bath 75x34 feet, 76 slipper baths and 50 troughs for clothes washing. The exhaust steam after leaving the engines in the generating station is conveyed to the baths, where it is put through heaters which supply all the hot water necessary for the whole institution, while live steam is also supplied direct from the boilers for clothes washing. The total cost of burning the refuse amounts to 3s 8½d (90 cents) per ton, including clerks and establishment charges and cost of repairs and engineering stores. The amount of electric energy consumed in burning and handling about 25,000 tons of refuse per annum is 4.98 units per ton.

GODDARD, MASSEY & WARNER'S DESTRUCTOR.

The installation described below was constructed by Messrs. Goddard, Massey & Warner, of Nottingham, for the Tottenham Urban District Council. The plant consists of a single row of ten cells of the back-feed type, with a grate and drying hearth at an inclination of 1 in 5, each with a grate area of 40 sq. ft. Forced draught is produced by means of fans, a separate fan being



PLAN

FIG. 1

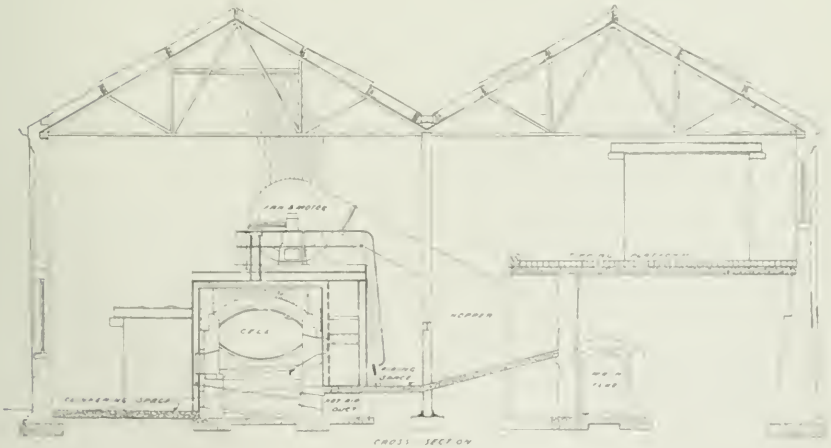


FIG. 2

HEENAN & FROUDE DESTRUCTOR AT STOKE NEWINGTON, ENGLAND.

provided for each furnace. Each cell is situated between a by-pass flue and a boiler. The gases from a pair of cells can thus be passed either along the by-pass or through the boilers when steam is required to be generated. Five multi-tubular boilers are provided, each slung between a pair of cells. Each boiler is fitted with both dead weight and double lever safety valves, and can be coal fired if necessary from an independent grate. The main flue is situated immediately under the drying hearth, and runs the full length of the destructor, enlarging beyond the last cell into a combustion chamber, into which carcasses and condemned meat, infected mattresses, etc., can be placed for destruction. A dust arrester joins the combustion chamber and is formed by a series of baffle walls, which facilitate the precipitation of the dust. At this point the flue divides into two parts, one giving direct access to the shaft and the other forming a space into which is built a Green's economizer of 160 tubes. Outside the building are fixed a clinker crusher, elevator and screen. The power for driving the fans and crusher is furnished by a horizontal single-cylinder steam engine. The feed water for the boilers is obtained from the town mains and after being passed through a Lassen and Hjort softener, is forced through a feed water heater into the boilers.

THE HORSFALL DESTRUCTOR.

An automatic tub feed four-cell destructor has been designed by the Horsfall Company, Ltd., of Pershore. The carts delivering the refuse at the works discharge their contents into one of two refuse tubs. These are raised by overhead traveling machinery to the top of the destructors, and their contents dropped therein, the furnace doors opening and closing automatically only while the charge is being delivered, so that little or no dust and smoke are permitted to escape. This is a very clean feed and only requires the attendance of one man. The power for working the hoist is supplied from steam generated by the destructors, two Babcock & Wilcox water tube boilers being provided for this purpose. These are placed in the center of the furnaces, two furnaces being arranged on either side. By-passes are provided from the combustion chambers, so that the hot gases can either be transmitted to the boilers or diverted direct to the dust catcher, placed at the base of the chimney. An aero-generator is also provided in the by-pass. Forced draught is supplied from blowers worked by means of a single-cylinder engine. The ventilation of the destructor house is effected by means of an air duct connected to the blowers in the manner described in connection with the Heenan & Froude destructor.

MUNICIPAL FINANCES.

By Charles J. Crawford, Formerly Alderman at Ft. Dodge, Iowa.

A CITY OFFICIAL, along with his numerous other duties must be a financier. He must be of an extraordinary type; since there are never any profits coming back as a result of his vast expenditures of money, and his master is critical of increase in taxes and of the results obtained. The notion may strike the taxpayer that his city financier is not as good as he ought to be, or that he has developed indications of grafting. Then there is a change of city officials, and a new crop must be educated in the science of municipal government.

The providing of funds with which to run a city is commonly as great a problem as their economical expenditure. Our laws have generally wisely limited our cities in the matter of tax levies, but in any growing city the demand for public service may often be greater than the rate of taxation allows. It then becomes necessary to provide additional revenues in other ways.

Taxation.—It is the duty of the assessor to fix the actual values and list every piece of real estate in the name of the owner, and to ascertain the taxable wealth of every individual and corporation. His completed lists are submitted to the Board of Review in the larger cities, commonly selected because of their particular knowledge of values, but in our smaller cities more commonly the city council. They must meet each day until their labors are completed, for not less than three hours work, for which the county commonly pays the munificent sum of $1.00 per day. The duties of a Board of Review are to examine and compare each item of the assessor's returns and see that property is assessed at its ac-

tual value and that all are assessed upon an equal or relative basis. That term "actual value" means that the city council should know more about values of property than the assessor, in order to fairly and equitably change his figures. Does actual value mean its forced sale value or what similar property sells at or a councilman's idea of its value? How many aldermen do you know that you would take their judgment to buy or sell property upon? However, if justice is not accorded property owners by the Board of Review they have right of appeal to our courts.

There are many serious and unsolved questions in this matter of assessment. Our railroads, telephone and telegraph companies and numerous other commercial institutions are separately assessed by the State Executive Council. These railroads are assessed upon a basis of miles of track. Upon this basis the country township gets its same share of taxes per mile as the city, notwithstanding the fact that the value of the railroad property in the city is many times that in the country township, by reason of the extensive terminals, yards, depots, roundhouses, etc. Furthermore our cities are at a constant and great expense in the matter of affording these railroad companies police and fire protection, vacating streets, paving and sewering and lighting them to facilitate the conduct of the railroad business. It is not the purpose of this argument to say that the railroads do not pay enough taxes, but merely to show that the division or apportionment of the tax paid is not equitable as between the cities and our rural districts.

The poor man with the little house and lot will pay taxes upon a valuation equal to its full value, and often these honest law-respecting men make full statements of their few hard-earned dollars saved for a rainy day. Our equalizing boards can quickly arrive at the full fair value of the little house and lot, but fail to find the hidden wealth of our "poor rich," rich in earthly possessions, poor in the sense of respect of law or honor of oath. Our corporations come nearer to paying their full proportion of taxes than do our individuals among the extreme rich and those who live on comfortable and even large salaries and yet pay not a dollar of taxes. Just how these persons evade the payment of taxes would take a book to tell. These conditions are wrong, unequal and unjust. Corporations were once favored in this way but of late years it has become more fashionable to make them pay nearer their just proportion of taxes.

The matter of assessing corporations in general, including our public service corporations, is an all important problem. Our courts are now commonly sustaining the taxing of franchises in the exceptional cases where this policy is followed by our cities.

The question of exemptions also presents a problem for serious consideration. Our state laws are often specific in exemptions to old soldiers and their widows, to churches and benevolent institutions, and even to some classes of manufacturing. In many progressive and growing smaller cities the custom of allowing exemptions from city taxes as an inducement for locating factories and other commercial institutions in a city, is very commonly in vogue. Exemptions on account of charity are very commonly seriously abused.

After the assessments have been confirmed the tax books are turned over to the county.

Upon a certain day in each year it is the duty of the city council to make a levy of taxes for the coming year. It is in the making of the levy that intimate knowledge of the city's requirements must be shown, as well as the business capacity of the city legislative body. A city should levy at no time more taxes than it actually needs. Surplus funds always lead to extravagance. In our larger cities it is required by law that estimates of the city's needs be made in advance and appropriations made out of the city's revenues to meet these estimates of expenses as allowed, and under no conditions is it lawful to exceed the expenditure of money appropriated for these various funds. In smaller cities and towns this business-like system does not generally apply, and things are run along in a slip-shod way, council meetings each week authorizing the spending of money for everything under the sun, paying little heed or attention to the city's actual needs, or income. Its warrants on its treasurer are soon outstanding in considerable amounts; the city is growing fast and its revenues are not sufficient to meet the deficit. The next step is the issue of bonds to cover this floating indebedness, which chiefly consists of expenditures for current requirements. Any policy which permits the creation of bonded debt for current expenses is a very bad one. Yet this is often necessary under ordinary methods of municipal finance.

The purpose of issuing city bonds

should be to raise funds for large or expensive improvements of permanent and lasting good to the community, such as city hall, light plant, hospital, water works, etc.

Municipal bonds are secured upon the ability of the municipality to levy taxes. The bond buyer or investor in them is assured of their security by many decisions of the Supreme Courts, which have invariably held our cities to the strict obligations of their bonds, irrespective of the purposes for which they were issued. Investors and bond buyers always look upon them with preference because they are always assured of a money return due to the city's taxing power, and the protection of a constitutional or statute limit of indebtedness.

Sinking funds are often provided to extinguish bonds, into which are paid each year specific sums. There is a question of wisdom of this practice in connection with the administration of city affairs, the accumulation of large sums of cash involving interest on deposits of city funds, yet investors more often prefer bonds which mature at some specific period, rather than the payment each year of a certain proportion of their bonds. In how many states do laws cover the keeping of these trust funds and the interest upon them, beyond providing for a city treasurer? The city treasurer of Chicago receives as a salary 25 per cent of the interest on city deposits. It is a common custom to pay a city treasurer a small per cent upon the funds he handles, which often makes the treasurer's office a fat one. In some cities it is a common evil for banks to present to city treasurers at times when balances are low large amounts of outstanding city warrants and have them made interest-bearing. Thus they not only draw interest on the warrants, but also have the use of the city's money on deposit for unwarranted periods.

Men are often successful in small business affairs and failures in large. The city's business is generally the largest in the community. Who is authority upon this problem in municipal government? Would not a state department of municipal control whose business would be to study these questions and adopt systems and methods that have been proven be of invaluable assistance to city councils? There is many a city today with a great debt, voted by the people in the support of a railroad, in some instances never built, or in some other wasteful proposition wherein the intervention of some higher authority and ability would have saved the community many thousands of dollars.

The following interesting lesson on the value of such a check on city officials was taught the author during his tenure of office as alderman. He happened to be with the mayor one morning when that official in opening his mail, found a letter from a man in Maine stating that he had purchased the day before certain bonds of the city which would mature a few years hence, and asking if there was any probability of these bonds being called or paid before maturity. It was a question that could have been answered yes or no or that the mayor did not know. But something induced us to ascertain what issue of bonds the letter referred to. We found that the administration of two years previous had refunded this series of bonds. Immediate search was instituted for the cancelled bonds, but they were no where to be found. The mayor soon got the wires hot after the firm that had bought the refunding bonds and also to the purchaser of these bonds, with the result that in about ten days the city got its cancelled bonds and a feeble explanation of how it happened. This was criminal carelessness upon the part of some city official at the time the refunding of the bonds was made. Had it been the ordinary renewal of a promissory note of any individual member of that council you may rest assured the old note would have been taken up, but city bond issues seem to have been surrounded with a mystic haze in which ordinary business methods are forgotten.

The policy of certain States permits municipalities to issue special assessment certificates in payment of all manner of public improvements of special benefit to abutting property, such as sidewalks, pavements, sewers, etc. The theory that abutting property is most directly benefited by pavements, sidewalks and sewers is without doubt correct. A common qualification in law, in paving or sewers, is that such benefits are never worth in excess of 25 per cent. of the assessed value of such property..

The question of intersections of streets and alleys is one in which varied customs prevail. Some cities pay for these intersections outright, assuming the improvement to be worth the cost of the intersection to the general public, and provide for the payment by general taxation. The intersection has, however, an important relation to each lot in the block and not

a few cities have equally divided the cost of intersection amongst the property in the blocks paved, or in all the blocks cornering on the intersections. In other instances cities have paid one-half of the cost of such intersection, distributing the other half to the property according to one or the other of the above methods.

The question of benefits in this connection is a puzzling and complex one. Take, for instance, a corner lot sixty feet frontage and 140 feet in depth paved front and side. Is it benefited the same per front foot as any inside lot in the block? The inside lot has sixty feet of pavement and the corner lot 200 feet of pavement. Street frontage is always an element of value in a corner lot, and it would for that reason be unfair to assess all property paved upon a per square foot basis, as is the custom in making special assessments for sewers. Sidewalks are more frequently built and assessed upon the frontage basis alone, but some cities take care of the intersections in the same way as they do those in street pavements, while in others the question is still unsettled and is giving trouble. To be fair to all these questions should be settled by a municipality and the adopted rule rigidly adhered to. Courts should treat with respect any well-defined policy of a city government on such questions. These are intricate questions and no rule that any court can draw will apply equitably to every piece of property in the estimate of benefits.

In sewer work the problem of special assessments involves the same intricate questions. A sewer naturally increases in size and cost from its source to its outlet. The property located nearer the outlet should not pay the cost of large pipes when smaller ones would serve his individual purpose. The equitable distribution of the assessment over the whole district benefited is the proper solution. If the whole system is not constructed at one time it is difficult in some states, if not impossible, to make such an equitable distribution. Other states, by means of distinctions between main sewers and local sewers, provide for different methods of assessing their cost and thus secure equitable distribution thereof. Even then there are occasional inequities which should have special treatment by the makers of the assessments.

The property owner, in various states, by waiving all questions of the legality and correctness of assessments, may avail himself of the privilege of paying them in five to ten yearly payments, at a nominal rate of interest. Such certificates are generally regarded as very desirable paper and find ready markets. The plan is good and often induces cities to make such public improvements. The problem for the city is to care for its proportion of these improvements, such, for example, as rebates accorded because of excesses over the twenty-five per cent. value of the property or the cost of intersections, which is no small proportion of the cost of the pavement, and if assessed upon the city might easily equal half or more of its revenue. Some states have provided means whereby a city can pledge a special tax levy spread over a specific term of years to meet such assessments. In other States the special assessments with deferred payments are not made, but estimates of the maximum cost of such improvements are made and suits are entered in court and judgments are entered against the property and forthwith collected. Contracts are then let for the improvement contemplated. These contracts are generally let for the completed work at a less figure than the estimates, and this difference is then refunded to the property owner. This has been a most unsatisfactory system, entailing all manner of municipal incompetency and trickery in recovering these rebates justly due, often tying up in the city treasurer's hands large sums of money.

Licenses.—The license problem of a city in the way of revenue is a most highly important one, producing as it does a large portion of a city's revenue. The greatest item is generally that of the saloon license, with greater innumerable and variable systems, from a per capita dog tax to a man's poll tax; licenses on public vehicles, as drays, buses, cabs and vehicles for public hire. Licenses from transient merchants and vendors should be carefully watched and rigidly enforced in justice to the resident tax-paying merchants of a city. The fines of municipal courts should not only sustain the courts, but prove a source of revenue. The public service corporation in lieu of any franchise provision for public compensation is often made amenable to this license feature of a city's authority in various ways. The collection of such licenses in our cities is very often seriously impeded by some political pull. How often do we find cities obtaining compensation from our public service corporations?

It would certainly seem that the un-

limited use of a city's streets by these corporations should be one of its greatest sources of revenue.

Municipal Accounting.—The complex nature of a city's business means a complex system of accounts, to properly care for the city's expenditures and receipts, directly embracing the offices of clerk, auditor or comptroller and treasurer. There is now well under way a general movement, the first step of which was taken by the Federal Government, to induce our states and if not prescribed by law of the states to induce our cities to adopt everywhere a uniform system of municipal accounting. This is undoubtedly the creation of the municipalities themselves, through various organizations of city officials. It is without doubt the best movement that has yet been made in the interest of greater uniformity in our cities. The State of Iowa has taken its first step in the matter of municipal control in providing an auditor, whose duties are to examine the finances of our cities and towns, require cities to make annual reports upon the uniform system recently adopted.

THE HIGHWAY SYSTEM OF LOS ANGELES COUNTY, CALIFORNIA.

By Burt A. Heinly, Los Angeles, California.

IN THE past ten years of marvelous highway construction throughout the United States, California was one of the last States of the Union to recognize the importance of the good roads movement. However, once her eyes were opened to the value of these betterments, she has undertaken to make up for lost time, and with the restless energy of the West, is seeking to accomplish in one year what other commonwealths would do in five. In this, Los Angeles county alone, with an appropriation of $3,500,000, plans for 307 miles of highways. No similar geographical division in the United States equals it either in point of expenditure or in mileage to be improved. At the present time the work now under way in this county is the largest of its kind west of the Mississippi river.

Bonds for the entire amount were voted July 30, 1908. A year later the extensive plans were commencing to materialize; today 85 miles of road are either completed or under contract, and by 1912 it is expected that the entire 307 miles will be in use by the public.

Not only the causes which led up to this determination on the part of the county to perfect its highways, but the methods which have been adopted, the rather novel course of construction and the materials used make the subject one of the most interesting in road-building history.

The causes were several. In the first place there has been a remarkable influx of population into Southern California in the past decade, an economic feature which of itself brought a demand for better highways. But this was intensified by the fact that where a few years ago ranches encompassed thousands of acres with little or no improvements, today they are represented by hundreds of small farms of from twenty to forty acres under highly intensive cultivation. Another cause of no less importance has been the use of the automobile. Los Angeles county is the Mecca of the motor car sales agent. Los Angeles city has more automobiles per capita than any other city in the United States, perhaps for the reason that autoing is possible every day in the year. Added to the local demand for road improvements by motor owners was that of hundreds of wealthy tourists, who bring their machines with them to the Pacific coast. These conditions gave the $3,500,000 bond issue an unusually large vote in its favor.

Early in 1907 the State Legislature passed a law creating a Los Angeles County Highway Commission. This was to consist of three members to be appointed by the County Board of Supervisors. The period of office was fixed at two years and the salary at $5.00 per diem, with traveling expenses. The membership of the first board, composed of Mr. C. D. Daggett of Pasadena, Mr. George Bixby of Long Beach and Mr. Martin C. Marsh of Los Angeles, who have succeeded themselves in office with the exception of Mr. Daggett, whose place on the board h as been taken by Mr. J. W. Calvert of Azusa.

Following its organization the new board employed as its chief engineer Mr. A. E. Loder, an engineer of ten

years' practical experience in road construction, and formerly of the United States Government Department of Roads. Mr. Loder came West with the highest recommendations in his favor. With his assistants he passed nine months in laying out a road system, so which will be offered for sale within the next few months.

With this introduction we are now ready to take up Mr. Loder's work of the past two years and some of the innovations he has introduced in road building.

REINFORCED CONCRETE BRIDGE ON LONG BEACH BOULEVARD, LOS ANGELES COUNTY, CALIFORNIA.
Across Los Angeles River, 320 Feet Long.

FINISHED BOULEVARD ON EL MONTE ROAD, LOS ANGELES COUNTY, CALIFORNIA.

that in July, 1908, when the voters went to the polls they had a very definite idea of what they were voting for. Legal delays in the sale of the bonds after they were passed made no money available until January, 1909, when $1,050,000 were sold at a good premium. These bonds bear interest at 4½ per cent., as will another issue of $1,050,000 now being prepared, and

It must be remembered that Los Angeles county still bears many traces of the old Spanish regime, and nowhere are these more in evidence than in the highways. In nearly every instance the roads have been developed from Spanish trails made before the Mexican war, which followed lines of least resistance, or mark the boundaries of Spanish grants of a century ago. It

was necessary, therefore, not only to shorten, straighten and reduce grades on old roads, but in many instances to map out and construct entirely new highways.

The system as it has been surveyed benefits 27 incorporated towns and a large number of town centers. By a glance at the accompanying map it will ge seen that these towns and villages are tied to each other and to Los Angeles by radial lines interlacing with belt lines. Here is found one advantage of the old Spanish custom of subdividing; the old land grants ran along angling lines, so that it has been possible to construct roads without regard to section lines.

The new roads connect with the highways of adjacent counties and are so laid out that one will be able to start at Santa Monica, follow a broad boulevard passing north of Los Angeles through Pasadena to the foothills, thence to Pomona and back to the ocean frontage at Long Beach; thence along the coast to San Pedro and Redondo and into Los Angeles, via Inglewood, or a total distance of 106 miles. In addition, the system provides for an air line from Los Angeles to its harbor at San Pedro, a distance of 11.5 miles, of which more will be said in the following, as the questions of freight rates and the auto truck are important of consideration.

Incorporated towns are not provided for in the appropriation, but Los Angeles now has under way a chain of boulevards which will unite with and become part and parcel of the county highway system. And in this both city and county are endeavoring to build an enduring pavement, which shall be free from mud in winter and without dust in summer, especially designed for motor travel, but of a durability to withstand the heaviest freighting.

Mr. Loder's preliminary investigations included over 1,200 miles of roads and a geological survey for road materials. In the latter the county is fortunate because excellent quarries were found and there is an abundance of heavy asphaltum oil to be had. Both of these requisite materials for road building are within a maximum distance of 35 miles from the points where they are to be used.

Three pieces of the work are being accomplished by force account, but the remaining portions are being done by contract. This latter policy will be continued unless it should be found advisable, on account of high prices, for the county to do the work itself. The aim is to apportion the contracts, each for about six miles of road or larger, up to the value of $200,000, if contractors can be found to handle them. The county furnishes the materials f. o. b. the nearest delivery point to the work.

The plan of the construction is thus: The roadway is first graded to give the easiest possible grades. On fills and in cuts it is made 40 feet wide. The maximum grade is 6 per cent., with mountain grades of 7 per cent. in one or two exceptional cases. Right-of-way varies from 50 feet to 100 feet, but in the majority of cases it is 60 feet. A California law enacted at the same time that the County Highway Commission was created provides that the maximum width of the pavement shall not exceed 16 feet. On each side of this there is placed a gravel shoulder 7 feet wide. The whole, coated with an asphaltic surface, makes a most satisfactory highway. At the super-elevation of all curves and at all angle corners special care is taken, some of the curves being "banked" as much as 18 inches on the outside. This provides for safe and comfortable riding.

The rock layer varies from 5 inches to 9 inches in depth, dependent upon the foundation, soil and the volume of traffic. Over the worst adobe an extra gravel foundation is placed under the macadam. The broken stone is used in the following four sizes:

No. 1—1½ inches to 3 inches in size.
No. 2—¾ inch to 1½ inches in size.
No. 3—¾ inch to ¼ inch in size.
No. 4—Rock dust under ¼ inch.

The stone is placed in two principal courses—a foundation course and the wearing surface. No. 1 stone is used in the foundation and rolled with a twelve-ton steam roller to within 2 inches of the finished surface. This is filled with No. 3 stone to the surface, with no excess, and this mass again rolled and sprinkled with water. It is now ready for the asphaltum treatment.

The first application of oil, which carries from 80 to 85 per cent. of asphaltum, is made in the proportion of three-fourths of a gallon to each square yard of surface and is accomplished by a special oil distributer attached to an oil tank wagon. No. 2 stone is then spread for the wearing surface to the thickness which will roll down to 1¾ inches.

Again the mass is rolled and, while still open, a second application of the liquid asphaltum is made in the same proportion as above. No. 3 rock screenings, free from dust, are applied in a

light coat and rolled in in sufficient quantities to barely cover the 1½-inch stone. The surface is now treated with another coating of asphaltum in the proportion of one-fourth gallon per one square yard of pavement and No. 4 stone is drifted over the surface to take up any excess oil and to provide the finishing surface. Occasionally in place of rock dust a coarse, sharp sand is used in preference.

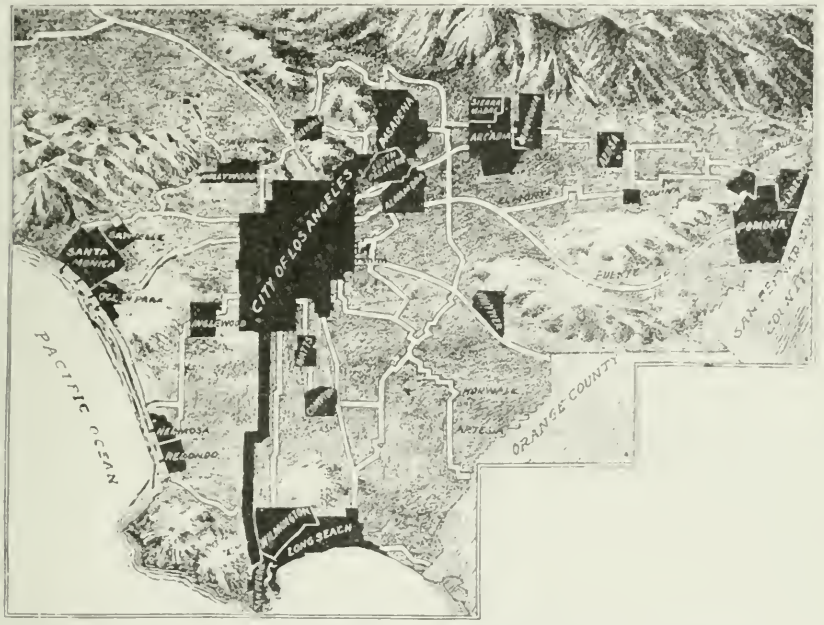
This part of the road is allowed to set for a few hot days and is then ready for traffic. It has a cross slope of ½ inch to the foot. Adjoining it on each side and with a cross slope of ⅜ of an inch to the foot are the seven-foot shoulders, which have been brought to grade and rolled, harrowed for one inch, treated with asphaltum in the proportion of one gallon of oil to one square yard of surface, covered to a depth of ⅜ of an inch with sand, gravel and rock screenings, then rolled.

The finished product is a substantial and thoroughly bonded roadway, ridged to carry heavy travel as well as automobiles. The sharp, angular stones have been thoroughly wedged so as to be almost impossible of displacement and the surface has been cemented with liquid asphaltum to a depth of 3½ inches, which forms a binder not to be displaced by the sheering and skidding of automobiles. Moreover, this highway is dustless, or practically so, cannot become muddy and is almost noiseless. It requires maintenance the same as a railroad as soon as it is opened to traffic, but with proper care and with average use a life ranging from 35 to 50 years is claimed for it.

In Southern California the average life of the average macadam road without maintenance and bituminous binder is placed at little more than a year. This is because of the long, hot, dry season, extending from the middle of April to the first of November. Heavy automobile travel also plays its part in road destruction.

Residence streets of Pasadena improved similarly, but not built with such perfection as the foregoing, have been in service for the past three years. They have been swept almost daily by heavy street sweepers and, without one cent expended for repairs, have a surface which today is as perfect as new asphalt, besides being much less noisy.

The method as described is being used throughout the entire 307 miles. Few figures for cost are thus far available. Conditions vary so greatly that it is almost impossible to give reliable data on the subject at this time, but the average cost of such construction, including all engineering and organiza-



MAP OF BOULEVARD SYSTEM OF LOS ANGELES COUNTY, CALIFORNIA.

tion expense, is about $11,400 per mile.

The harbor road from Los Angeles to San Pedro will probably have a solid concrete foundation, for the reason that it is planned to make of it an auto-truck highway from the docks to the wholesale district of Los Angeles. For years the city has fought the Southern Pacific Railroad Company for a reasonable freight rate to the sea and, having failed repeatedly in this, the municipality has resolved to build a highway so perfect and of such an easy grade—not to exceed 2 per cent.—that motor trucks can enter into competition with steam and iron rails. The outcome will be watched with much interest.

It is estimated that nearly 1,000,000 tons of rock will be required for macadamizing, and for this purpose the county has purchased two quarries, from which an excellent quality of rock is being taken. In each instance the rock is of volcanic origin, known as an andesite, a trap rock which stands high tests for wearing qualities, toughness and cementing properties.

The Pacoima quarry is 20 miles north of Los Angeles and here a crushing plant has been erected at a cost of $50,000. The plant, which was opened the last of March, has a capacity of 1,000 tons per day at a cost of 50 cents per ton, and when the road is completed it is estimated that the property will have a salvage value equal to the price that was paid and the improvements made. A standard gauge track has been laid for three-quarters of a mile to the main line of the Southern Pacific, so that it is possible to deliver rock from this quarry at a minimum of expense.

The other quarry, known as the San Dimas, is located 30 miles east of Los Angeles and has in sight 15,000,000 tons of volcanic andesite. It was formerly owned by an old hermit, who considered the huge rock pile useless, and he counted himself fortunate when he found a purchaser in the county for the sum of $3,000. Afterwards it was hard to convince him that he was not the robber, but the robbed. This quarry has been leased to a contractor for a period of ten years, the agreement being that the county or the Highway Commission is to be furnished crushed stone in any quantity not to exceed 1,200 tons per day at 55½ cents per ton. The county agrees to take 500,000 tons, or more, on the present work. A crushing plant is being installed and will be ready for operation by the end of May.

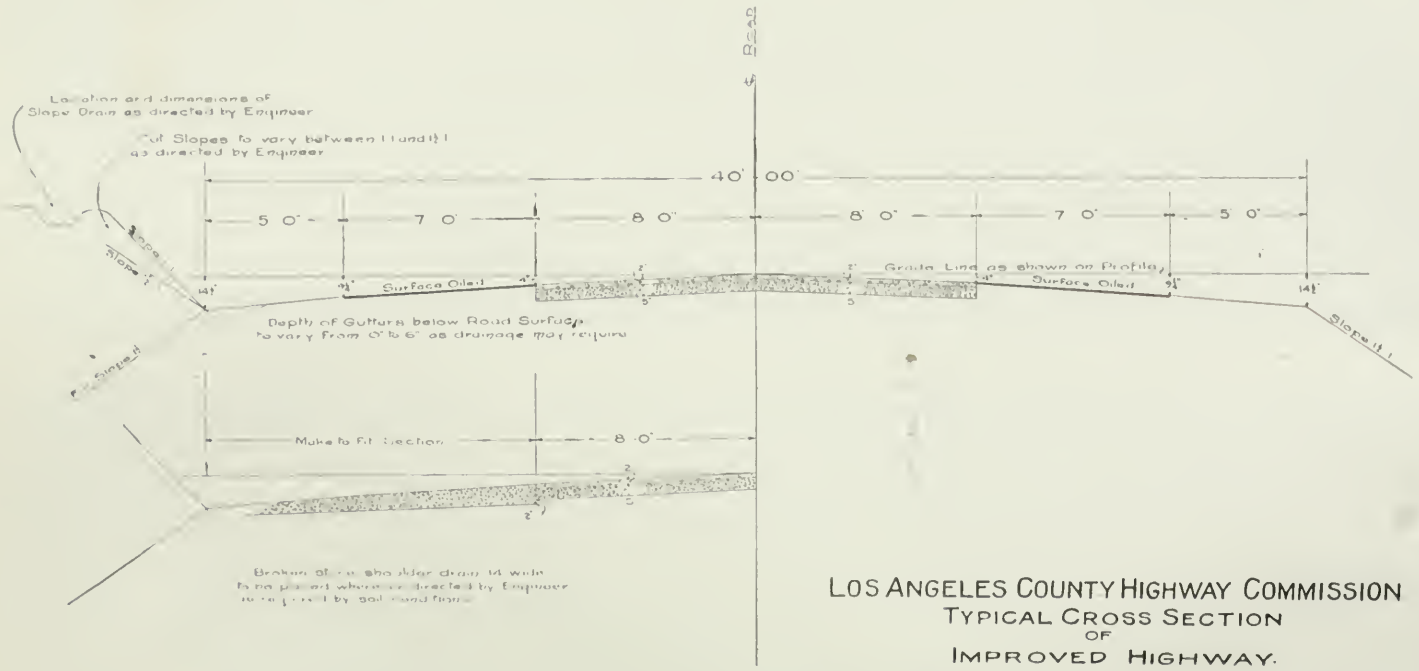
From the map it will be seen that the quarries are admirably situated at almost opposite ends of the county and on different railroad lines, so that all portions of the roads in building can be furnished with crushed stone at a low cost for transportation.

Oil is to be had from several different fields within the county limits, but the Whittier and Fullerton fields are being drawn upon principally. The oil used is a special oil residuum, which is required to contain at least 80 per cent. asphaltum. The latest bid to furnish oil was at the rate of $1.00 per barrel at the refinery, or $1.04 at the county oil pit. This oil reservoir is situated in Los Angeles, where it is accessible to two railroads and one electric line, and has a capacity of 15,000 barrels. It is built in the sand with timber bulkheads to prevent seepage, and is provided with a steam pump and heating apparatus.

The most difficult portion of the work is being accomplished in Fremont Pass, better known as the infamous Newhall Grade, 30 miles northwest of Los Angeles and the scene of many an automobile accident, where several lives have been lost. Here, to get over the summit of the low range of mountains, a defile 90 feet deep, 15 feet wide at the top and 12 feet in breadth at the bottom, was cut some years ago through the shale sandstone for a distance of 200 feet. It is approached from the south side by a circuitous road with a grade of 23 per cent., and on the north side by a 22 per cent. grade. An attempt was made to find a 6 per cent. grade over this summit, but the plan was not feasible and the county resorted to tunneling.

The tunnel, which is to be cut through solid rock, is to be 435 feet long and will reduce the grade to 6 per cent. It is to be 20 feet wide and 18 feet in the clear. The arch section is rather unusual. There is a semi-circular arch of 10 feet radius, while the supporting walls, 7 feet in height, have an invert radius of 46 feet. The tunnel is to have a concrete lining ranging from 21 to 24 inches in thickness. In some instances the approaches, which are each a mile in length, are blasted seventy feet to grade on the high side. All the excavation is being made in rock. The contract for both the tunnel and the approaches was let in December, 1909, for $63,364 and the work is to be completed by July 15, 1910.

Another point which for years has been a source of inconvenience to traffic is the Big Tejunga wash, where the channel of the shallow stream is not dependable and of which every rain in


Road
Location and dimensions of Slope Drain as directed by Engineer
Cut Slopes to vary between 1 and ½ 1 as directed by Engineer
40' 00"
5 0"
7 0"
8 0"
8 0"
7 0"
5 0"
Slope 1:1
Slope 1:1
Surface Oiled
Surface Oiled
Grade Line as shown on Profiles
Depth of Gutters below Road Surface to vary From 0" to 6" as drainage may require
Slope 1:1
Make to Fit Section
8 0"
Broken stone shoulder drain to be placed where so directed by Engineer to be paid for at the contract price per ton for Crushed Rock

LOS ANGELES COUNTY HIGHWAY COMMISSION
TYPICAL CROSS SECTION OF IMPROVED HIGHWAY.

Scale — 0 1 2 3 4 5 — Feet

A E Loder Chief Engineer

the mountains makes a passage attended with difficulty and some danger.

Most California rivers flow upside down, that is, the subterranean flow under normal conditions is as large as, or in many instances exceeds, the surface flow. The Big Tejunga is no exception to this rule. It is not bridged and farmers with teams reap a rich harvest during the winter season from the unfortunate automobilists who become caught in the sands. To make a passage of this ill-favored place both safe and easy the wash is to be spanned by four bridges, practically temporary because of the changing and rising channels. These bridges will have an aggregate length of 1,216 feet. The abutments are to be concreted, the piles of reinforced concrete and the decks of timber with asphalt paving. The piles will be set in place for the reason that the boulder wash prevents driving or jetting. One of these structures has just been completed, as shown in the illustration. The remaining three are yet to be built, but will be in place in time for next year's flood season.

Another structure of much interest is the bridge on the boulevard which connects Los Angeles with Long Beach. This bridge spans the Los Angeles river and is a simple structure 320 feet in length. It is of reinforced concrete with 19-foot spans, carried by floor beams on 26-foot concrete piles jetted and driven. The flooring consists of concrete slabs 13 inches in thickness. The cost was $12,000. One of the accompanying photographs shows it.

In all bridges the most permanent and highest class of construction is employed, with the exception of those across the Tejunga, and these are made semi-temporary by the conditions which they are built to surmount. Reinforced concrete is used in nearly every instance, as in the case of culverts, excepting in some instances where corrugated metal of a non-corrosive iron is employed.

In the construction of the Long Beach Boulevard, which is an entirely new road over a new right-of-way, and built in an airline, it was necessary to make a cut of 500 feet in length through a hill of very sandy soil. The excavation is 100 feet wide at the top and is 22 feet deep, while the sides have a slope of 1½ to 1. To prevent wind and rain erosion, a rather novel scheme was adopted. The slopes have been covered to a depth of 4 inches with barn manure and this is held in place by wire chicken fencing with a two-inch mesh, staked 3 feet by 3 feet. The whole is to be planted with morning glories, misembry antheum or other similar vegetation. The cost did not exceed $500. In this, as in most of the grading that is being done, the work is accomplished with steam plows and elevating graders.

Owing to the very large amount of road and street improvements in progress within Los Angeles and other incorporated towns independent of the county construction, there is a dearth of contractors equipped with the proper machinery and who are able to bid on the contracts. The Highway Commission is especially anxious to interest contractors from a distance who are prepared to do the work on a large scale, and an excellent opportunity is offered to individuals or companies capable of handling large contracts.

At the present time the organization is in a position to carry on construction with great facility because of the opening of the stone quarries and the completion of the crushing plants. Five miles of roads have been completed, 75 miles are under construction, advertisements to construct another 60 miles have been published and the engineering department is rapidly preparing specifications for the remainder.

Ranging in size from $50,000 to as high as contractors can be prevailed upon to undertake the work, the magnitude of each contract makes it possible to place an engineering superintendent on each job and the construction is watched with the same closeness as if it were under force account. To this supervision is added that of a cost-keeping department, lately organized, which itemizes all work and all materials entering into it.

The time estimate for the completion of the whole road system will be determined by the rapidity with which crushed rock can be procured. Now that this problem seems to have been solved, it is expected that 1912 will see the entire 307 miles open to traffic.

In closing, a word must be said about the street and boulevard system of the city of Los Angeles, in many respects as remarkable as that which the county is installing. In 1904 Los Angeles, for a city of its size, had the worst streets of any city in the country. A year later there began a remarkable reformation, due largely to the vigorous campaign which was waged by the Municipal League. Today all of the leading thoroughfares have been paved with asphalt. These will connect with the county boulevards, and in four instances where bridges are required, the

municipality is rearing stately structures at a cost of $1,000,000.

The whole city and county system, when completed, will give to Los Angeles county a network of broad and enduring roads, making every section of the territory readily accessible and offering scenic attractiveness ranging from long stretches of level beach to mountain heights, which it will be difficult anywhere to surpass.

STERILIZATION OF WATER.*

By Walden and Powell, Baltimore County Water and Electric Co., Baltimore, Md.

THE sterilization of public water supplies has been the subject of careful investigation by many municipal and private corporations for the last two or three years, and more so in the past year, owing to the shortage of water and the fact that many supplies, including wells, reservoirs and small streams became badly polluted due to wash when there were rains and at other times when there was not sufficient water to properly flush the streams or surface to prevent pollution from such wells through the sand strata. These investigations have invariably met with the obstacle which has been the stumbling block in all such enterprises, that is, first cost and operating cost of the purification system.

The Baltimore County Water and Electric Company have been operating a filter plant for a number of years and being desirous of obtaining a cheaper method of sterilization, have from time to time been investigating the various methods of filtration, namely, slow sand, American or rapid sand, and the up-draught system of sand filtration here, as well as the European. This company has also experimented for several years with the application of alum and hypochlorite of lime applied directly in the reservoirs or storage basins themselves, with considerable success, as will be shown in this paper.

In addition to the above-mentioned careful investigations, the sterilization of water by ozone was considered about two years ago. The United Water Improvement Company controlling the James H. Bridge patents, submitted a sample 3,000-gallon ozone sterilization plant for test, which was placed alongside the American or rapid, and slow sand filters, handling raw water directly without sedimentation. Some of the results obtained from this sample plant have already been reported in a paper on the use of hypochlorite of lime, which has also been in use both in the American and English filters for some two years. In addition to these tests, a rough determination of the amount of nascent oxygen in a grain of chloride of lime has been made, and the approximate calculation of the volume of gas on a basis of .1 grain per gallon, to get an approximation for the volume of ozone, which was roughly .00096 cubic inch per gallon, but this depends upon the concentration and will vary with the condition of operation and temperance. The specific gravity of ozone throughout the test has been taken at 1.65, as compared with air as 1.

With the data at hand, the ozone plant at Lindsay, which had just been started, was investigated, and it was decided to install a sterilization plant at the Herring Run Station of the Baltimore County Water and Electric Company, to have an ultimate capacity of 10,000,000 gallons in 24 hours with roughing filters to remove the suspended matter, to handle the raw water at double or triple the usual rates per unit area in rapid or American sand filters. Plans were gotten out and work started, but considerable difficulty was met with owing to quicksands. The sterilization pit was thirty feet deep and within twenty-five feet of the river bank. The walls were not completed until it was late in the fall. Work had to be abandoned during the winter other than to test the many different kinds of mixing head or aspirators, including various nozzles, converging tubes, orifices, etc.

As it was important to get information as to the amount of air that could be mixed with a given volume of water under our low head, it was found that under low heads some aspirators would not give a continuous draught of ozone or air, and when the draught was heavy the specific gravity of the mixture would become so light that there

*From a paper before the American Water Works Association.

would be a blow-back, which would momentarily blow the ozone input back, and while it was possible with low heads to get about one-third ozone to water in volume, the lowest point or head that should be considered is about twelve feet. Though some changes which were made in the design of this plant and adopted at Ann Arbor, Mich., will allow the use of heads of from six to ten feet, same will not give a steady input of ozone, as it is intermittent. This, together with the use of a small blower, seems so far to be satisfactory.

The area required for plant of size installed is only about one-tenth that required for American plant, and is not to be compared with the area required for slow sand filters. The sterilization plant proper constitutes raw water chamber, aspirator heads, ozone chambers, ozone generator, as well as time contact basin or mixing cell. The latter compels the water to travel horizontally as well as vertically, so as to give water the benefit of as long contact as is possible with ozone.

The ozone generator consists of boiler plate, shell and head, containing each 109 two-inch aluminum tubes, inside of which are micanite tubes or dielectrics, inside of which is another tube or cylinder which rests on a tray, which is connected to one terminal of a special 10,000 to 15,000 volt static transformer. The other terminal, which is a ground terminal, is connected to boiler plate shell; inner and outer tubes being so close and only separated by micanite tube, allows a continuous violet discharge to take place through the dielectrics, and the passage of air through this discharge produces the ozone, the production running from eighty to one hundred grammes per k. w., and the concentration of five or less, depending upon the condition, velocity and the temperature of the air discharged.

Sparks must be prohibited, as when a sparking condition takes place nitrous oxide is generated, and also high temperature should be provided against in the generators.

There is under construction another type of ozone generator, which from test on a small experimental unit has given as high as sixty grammes of ozone, with concentration of twenty, but it is too soon to say how this will work out in much larger sizes. This company expects, however, to have one of these generators in use soon for test, and more definite results will be obtained. The ozone generator may be either water, oil or air cooled. If it is air cooled, the outer shell has to be removed and the top and bottom heads supported by four rods, or a frame used, and air caused to circulate by any means between and around the outside of the fixed tubes.

The ozone generator in use here will be cooled by oil, to prevent, if possible, the sweating of the tubes when water is the cooling medium, as the oil will remain for some time after current is cut off, preventing moisture collecting and giving trouble at starting. The only trouble to be feared with oil cooled system is leakage, owing to the fact that it is a hard matter to get joints that will stay tight under oil pressure, although the pressure will not exceed from two to three pounds under any condition. Oil is circulated by means of ½ h.p. motor belted to rotary pump, the oil being passed through copper coils in a tank or cylinder through which water is flowing continuously. Each generator has its thermometer for determining the temperatures, and a controlling panel on which will be mounted indicating wattmeter, potential transformer plug, high tension switch, voltage regulating head which will permit of handling 2,300 volt current on the primary side of the transformer in such a manner as will give voltage of the secondary side of the transformer range from 7,500 volts to 15,000, or to be varied to intermediate volts. In addition to this there is a voltmeter reading to 15,000 volts, power factor meter, and frequency indicator. These panels are located over a concrete vault in which are located the transformers. Each million gallon unit requires 5 k.w. in transformer capacity. All the switching is done at 2,000 volts on the primary side, and the high tension side is connected directly to the ozone generator through varnished cambric lead-incased cable two-conductor, placed in bituminized fiber tubes, encased in concrete.

Owing to the weather conditions and the fact that some of the apparatus for this plant, such as insulators, etc., were special, and the departure from the original design, continuous tests have only just begun on this plant.

Considerable information was obtained, on some of which further experiments will be carried out, to determine what would appear to be the slip of the bubbles of ozone or air, and the fact that they do not seem to fall at the same velocity with the water, or for some reason do not receive or hold the kinetic energy imparted to them, and the fact that the

bubbles seem to rise at about .75 of a foot per second, this together with the fact that the specific gravity of the air bubbles and water, when the amount of ozone or air reaches certain entrainment, is so low that it loses its kinetic energy and the blow-off is caused, previously mentioned, and is similar to the action of the air lift, the mixture looking like soap bubbles in the down pipes momentarily.

When the temperature of the atmosphere is at or below zero, the strength of the ozone seems to be greater, and the absorption by the water varies, as the strength of the ozone given off by the water in the relief chamber over the time contact basin or pit is noticeably less to the smell, and a longer or shorter time is required in high temperatures or extremely cold weather before the ozone is noticeable. But the ozone in this relief chamber becomes noticeably thin when the temperature is high, but varies. Bunsen and Carius found that one hundred volumes of water near freezing absorb four volumes of oxygen and two volumes of nitrogen; and the absorption is quickened by stirring or mixing. Tests are under way to ascertain more fully this relation to the absorption of ozone as water absorbs more air, and the more of it the lower the temperature; also it absorbs more oxygen than nitrogen. It is to determine this relation when ozone is mixed with water, as no data are available at the present time, that experiments are being made. From this, it seems that these gases, when absorbed, are given up as pressure lessens, that is, given up in minute bubbles, similarly to water which is highly charged with air and allowed to stand in a glass, which gradually becomes clear at atmospheric pressure. A cubic foot of water holds in solution about 0.029 cubic foot of air at about freezing point, and it is possible that the absorption or change increases or decreases the CO_2 in the water when ozone is applied.

The generators require about eighteen watts per square foot surface in the electrodes at sixty cycles, and twenty-one watts per square foot at one hundred cycles, but it is hoped to materially reduce the wattage with the new form of generators.

The tests below, which have been carried on under Mr. Powell's supervision, will undoubtedly prove very interesting.

OZONE RESULTS.

DATE		Bacteria		Coli		Color		Turbidity	
		Raw	Ozone	Raw	Ozone	Raw	Ozone	Raw	Ozone
December	10-09	1840	6	2/4	0/4	20	15	15	15
	11-09	1800	8	4/4	0/4	20	14	16	14
	13-09	15000	80	4/4	0/4	45	12	180	180
	14-09	4000	1620	3/3	1/4	35	28	80	80
	14-09	4000	1410	2/4	0/4	34	30	80	80
	15-09	1950	22	1/4	0/4	16	11	20	20
	16-09	1500	960	1/4	0/4	16	10	18	18
	17-09	1120	870	1/4	0/4	16	12	18	18
	18-09	1960	1500	2/4	0/4	17	12	20	20

14th, 16th, 17th and 18th shows the effect of moisture on the tubes.

The company's filtration plant at Avalon, Md., which has already been mentioned, consists of slow sand and mechanical filters, and an experimental ozone apparatus. Since the construction of the rapid filters, about two years ago, hypochlorite of calcium has been used for sterilizing the water in connection with filtration at this plant. The hypochlorite has not been used continuously, as at times the raw water contains but a few hundred bacteria per cubic centimeter. The object in using the bleach has not been necessary because of the failure of either system of filtration, but to lessen the cost of operation and at the same time to deliver water which was practically sterile.

Experiments also were carried on in the laboratory for a better knowledge of the action of the bleach upon the raw water, and to determine the bacterial efficiency under abnormal conditions.

The hypochlorite of lime used was received in 750 sheet iron drums. Only a small opening was cut in the drum so that it could be tightly sealed to prevent rapid deterioration of the chemical. Average analyses of the bleaching powder contained 34.2 per

cent. of available chlorine. A 0.5 per cent. solution was used and was applied to the water through a graduated orifice. The storage solution tanks are of reinforced concrete and have a capacity of 41.5 gallons. The solution flows from the storage tanks to the orifice boxes which also are made of reinforced concrete. The head of solution upon the orifice is kept constant by a value controlled by a ball float. The tanks and boxes before being used were painted on the inside with elaterite paint, so there has been no trouble from leaking. The orifices were graduated at the plant and have been checked from time to time as to their accuracy.

In making up the solution, the required amount of bleaching powder is first dissolved in a small quantity of water to insure thorough breaking up of all lumps. This solution is then put in the storage tank and the required quantity of water run in.

Under ordinary conditions the capacity of each tank is sufficient for four or five hours' supply. By making up the solution so often, the hypochlorite does not lose its strength to any appreciable degree, and it is not necessary to change the setting of the orifice unless there is a change in the character of the raw water.

The table given here shows the amount of bleach in grains per gallon applied to the water at different settings of the orfice. It will be noted that the chemical is given in grains per gallon and not as parts per million of available chlorine or oxygen. The only object in doing this is that grains per gallon is more easily understood by the filter operators than the other terms mentioned.

There was an apparent increase in the bacterial reductions from the bleach when used in connection with sulphate of alumina, over the reduction obtained when bleach only was used. Experiments were undertaken in the laboratory to determine if this condition existed. Tests were made upon the raw water with conditions as near those at the filtration plant as was possible to obtain. One set of samples was treated with various amounts of bleach from 0.05 to 0.5 grains per gallon of water. To another set of samples were applied the same amounts of bleach, but to each jar of water was added sulphate of alumina at the rate of 0.5 grain per gallon. Several of these tests were made during the year and the curves given here were platted from an average of these tests.

Although there was not a great difference in these results, still it is interesting to note that the curve platted from the results when alum and bleach were used runs uniformly below the curve when bleach only was used. With highly polluted water this condition would no doubt be more pronounced than it has been here.

The color of the raw water at Avalon ranges from 5 to 65 parts per million, most of which is not in true solution, but in a collodial state. The water is more highly colored during spring and fall floods than at other times of the year. The effluent from the mechanical filters is colorless at all times, also the effluent from the slow-sand beds, when the color of the applied water is below 20 parts per million. When the color of the raw water is greater than this, there is always some color in the filtered water from these beds.

By the use of hypochlorite of lime it has been possible to reduce this organic stain from 5 to 15 per cent., the

TABLE TO BE USED IN THE APPLICATION OF HYPOCHLORITE OF LIME.

Capacity of storage tank, 41.55 gallons.
Charge of bleach, 2 pounds.
Orifice graduated in inches.
Rate of filtration, 1,025,000 gallons per 24 hours.

Graduation on Orifice Scale	Drop of Solution in Tank in Inches per Hour	Grains of Hypochlorite of Lime Delivered per Hour	Hypochlorite of Lime	
			Grains per Gallon of Water Filtered, One Filter in Operation	Grains per Gallon of Water Filtered, Two Filters in Operation
1	1 in.	583	.026	.013
2	2 in.	1166	.032	.026
3	3 in.	1749	.078	.039
4	4 in.	2332	.104	.052
5	5 in.	2915	.130	.065
6	6 in.	3498	.156	.078
7	7 in.	4081	.182	.091
8	8 in.	4664	.208	.104
9	9 in.	5247	.234	.117
10	10 in.	5830	.260	.130

percentage reduction depending on the character of the color, the amount present, and the quantity of bleach used.

An attempt was also made to determine the effect of hypochlorite upon organic matter as measured by the required oxygen. These experiments, as those upon color, were done at the laboratory and consisted of treating liter samples of raw water with bleach varying from 0.05 to 0.5 of a grain per gallon and determining the organic matter before and after treatment.

From the data at hand, the reduction of organic matter by the use of hypochlorite was hardly noticeable even with water high in organic matter, and when comparatively large quantities of the chemical were used.

To determine the efficiency of the bleach on the operation of the mechanical filters, a two months' test was run. The filters were operated during the month of November, using only alum. During December, from the fourth to the end of the month, hypochlorite of lime was applied with the coagulant. There was but little change in the character of the raw water during this period, so the results can be compared fairly well. By the use of a very small amount of the hypochlorite (averaging 0.087 grains per gallons) it was possible to reduce the alum from 0.87 to 0.58 of a grain per gallon.

The percentage of water used in washing the filters was reduced from 4.1 per cent. to 2.9 per cent., at the same time increasing the length of time between changing the filters one hour and ten minutes. This reduction in coagulant of 0.22 of a grain per gallon amounts to 31 pounds per million gallons; with the cost of alum at $1\frac{3}{5}$ cents per pound f.o.b. Alavon, the saving was 41 cents per million. Deducting from this amount 11 cents for the amount of hypochlorite used, leaves a net saving in the cost of coagulant of thirty cents per million gallons. The actual saving in the operating expenses really amounts to much more, as to this must be added the saving in wash water and the increased amount of water passing through the filter between cleaning.

The average number of bacteria of all samples of filtered water taken during November was 18 per cubic centimeter, while in December, when the bleach was applied with the coagulant, the average was 8 per cubic centimeter.

Tests also were made to determine the effect of hypochlorite of lime upon water of high turbidity. The results from these experiments have shown that as the turbidity increases, the bacterial efficiency of the hypochlorite decreases. This is partly due to the increase in organic, which invariably increase with the turbidity, and partly to the bacteria being mechanically protected by the particles of matter in suspension. With water having a turbidity greater than fifty parts per million, the hypochlorite of lime gave better bacterial results, when part or all of the turbidity was removed before treating with the chemical. This work has also shown that with the raw water at Avalon, increasing the dose of hypochlorite about 0.10 of a grain per gallon, but slightly increased the percentage reduction in the number of bacteria.

The use of hypochlorite of lime at this plant has shown that:

The effluent from both the slow sand and mechanical filters can be made practically sterile, with the total elimination of B. coli, reducing the color from 5 to 15 per cent.

To reduce the amount of alum and to increase the length of runs between changing the filters, and at the same time reducing the amount of wash water.

Also that hypochlorite of lime is more efficient when used with alum than when used alone.

That high turbidity in the raw water reduces the bacterial efficiency of the hypochlorite of lime.

And that the hypochlorite of lime even when used in large quantities causes but a slight reduction in organic matter.

PERCENTAGE OF RECEIPTS AS COMPENSATION FOR STREET RAILWAY FRANCHISES.

THE following information regarding the practice and the results of assessing percentages of the receipts of street railway companies as compensation to the city for granting the franchise has been gathered in response to an inquiry published in the "Question Department." The data have been collected from various sources and show considerable variation in practice. As stated in the answer to the question referred to, there are other methods of securing compensation for street railway franchises, but on account of the limitations of space they are omitted from this article. All the receipts from the street railway companies are given whenever possible,

for the percentage of receipts may vary on account of the collection of other forms of compensation.

Mobile, Ala., received from its street railroad company in 1907 a percentage of the receipts amounting to $1,436, car license fees of $500 and property taxes of $8,742.

In 1907, Little Rock, Ark., collected $500 fixed annual rental of street car privileges, $3,556 percentage of receipts, $845 license fees and 6,450 property taxes.

California provides for the sale of franchises to the highest bidder and 2 per cent on the gross receipts after 5 years, San Francisco on franchises hereafter granted to receive 3 per cent first five years, 4 per cent next 10 and 5 per cent the last 10 years of their life. Car licenses of $25 are also provided for, except San Francisco, which is 50 a year.

In 1907 San Francisco received $100 annual rental, $35,449 percentage of earnings, $7,478 from license fees, and $277,402 other taxes. In 1906 Los Angeles received from its street railway companies $59,493 in taxes, $9,337 in license fees, and $1,000 payment for public service privileges; in 1907, $800 sale of privileges, $80 annual rental, $2,944 license fees, and $199,122 taxes. Oakland received $40,028 from taxes and $2,617 for privileges; in 1907, $2,750 sale of privileges, $100 annual rental, $3,007 percentage of receipts and $38,198 other taxes. The special report on street and electric railways for 1902 states that Sacramento received $125,000 from street railways in 1902. The gross earnings for the year were somewhat more than $750,000.

In 1906 Denver, Colo., received from street railway companies $70,727 as taxes, $2,972 as license fees and $35,000 for public service privileges.

Bridgeport, Conn., received 5,000, gross earnings about $400,000; Hartford received $21,929 from its several roads, or 2 per cent of the gross fares collected in the city; New Haven collected $2,250 from several roads; and Waterbury $3,177, gross earnings about $200,000, from street railways for public service privileges in 1906. In 1907 Hartford received $7,500 from sale of privileges to street car company, $15,900 from percentage of earnings and $266 other taxes.

Washington, D. C., collects 4 per cent on gross receipts and 1.5 per cent on real estate, amounting in 1907 to $178,776, and also received $11,164 from a charge of ½ cent for each passenger across a bridge.

Jacksonville, Fla., received in 1907 $7,496 from percentage of earnings and $9,608 from other taxes of street railroad property.

Atlanta, Ga., received 1 per cent. of gross earnings the first three years and will receive 2 per cent. the next 20 years and 3 per cent. thereafter during lives of franchises, also a cash payment of $50,000. The receipts in 1906 were $28,049 percentage of earnings, and $33,086 other taxes; in 1907 they were $800 annual rental, $30,984 percentage of earnings, $300 from licenses and $71,458 other taxes.

Chicago, Ill., receives 55 per cent. of the net receipts, which was $53,527 in 1907, in addition to $20,567 from sale of privileges, $112,082 license fees and $601,190 other taxes.

Evansville, Ind., provides for step by step increase from 2 per cent. of gross receipts for first 12½ years to 4 per cent. for last 12½ years of 50 year franchise. In 1900 the payment was $3,485. In 1906 it was $5,467 for franchise privileges and in addition $9,594 in regular taxes and in 1907, $175 for rental of privileges, $5,979 percentage of receipts and $11,410 regular taxes.

Des Moines, Iowa, collects 5 per cent. of gross earnings and regular property tax. The receipts in 1907 were $464 for the former and $17,498 for the latter.

Kansas City, Kan., received $17,442 percentage of receipts, $3,099 annual rental of privileges, $5,979 percentage erty taxes from its street railroads in 1907.

New franchises in Louisiana must be sold to highest bidder on percentage of gross receipts. In 1906 New Orleans received $257,978 in taxes, $12,345 from licenses, and $10,485 for public service privileges from companies operating street railway and combined street railway and electric lighting plants. In 1907 the receipts were $292,047 from taxes, $14,977 from licenses, $1,450 from rental of street car privileges and $30,241 from percentage of gross receipts.

Portland, Me., received $4,000 from percentage of earnings in 1907 in addition to $5,948 in taxes.

Baltimore, Md., receives 9 per cent. of gross receipts and a low car license, amounting to $324,398 in 1900. The gross earnings of the company from all sources were about $4,300,000. In 1905 the city received from the company, which also furnishes some light and has some lines outside the city, about $400,000, in 1906 it received $433,312 for franchise privileges, $3,500 from licenses and $163,278 from taxes; and in 1907 it received $225 annual rental, $430,095 percentage of earnings, $3,750 licenses and $89,044 taxes.

Massachusetts has a very elaborate law governing street railway corporations and their taxes, and the sum of all the taxes provided for amounts to nearly 7 per cent. of the gross receipts. The receipts in cities outside of Boston varied in 1906 from $2,828 for public service privileges and $5,836 from taxes on street railways in Fitchburg to $24,988 for public service privileges and $42,049 from taxes in Springfield. New Bedford collects $3,000 a year license fee. In 1907 these receipts varied from $78 percentage of earnings and $3,105 taxes in Fitchburg, to $22,859 percentage of earnings and $91,618 taxes in Cambridge and $76,953 percentage of earnings and $452,241 taxes in Boston.

In Detroit, Mich., some of the lines pay percentages of gross receipts, 1 per cent, 2 per cent and $2\frac{1}{2}$ per cent and others nothing. The city received $30,823 in 1902 from these percentages. In 1907 the receipts were $6,936 from interurban express service and $48,804 percentage of receipts.

New franchises in St. Paul, Minn., must pay 5 per cent of gross receipts, but this is not retroactive on the older franchises.

St. Louis, Mo., street railroads pay various percentages, and in 1902 the city received $105,858 from special percentage taxes and $24,750 from car license fees at $25 a car. The license fees do not appear in the report for 1906, but the city received $131,573 from franchise payments and $270,489 from taxes on street railroad property; in 1907 the receipts were $106,000 annual rental of privilege, $29,647 percentage of earnings and $418,326 from taxes.

Kansas City railroads paid $124,834 franchise fees in 1906, and $84,367 in taxes. A later franchise assesses company 8 per cent of gross receipts from which city pays county and state taxes, leaving about $120,000 net to the city in one year. The receipts in 1907 were $123,728 from the percentage of receipts, $1,200 annual lump sum payment and $156,443 property taxes.

Lincoln, Neb., received $3,131 percentage of receipts and $10,214 property taxes in 1907.

Newark, N. J., was reported in 1902 to require 5 per cent of gross receipts and license fees of $10 a car. The two amounted to $86,797 in that year and $139,016 in 1907. Paterson's $2\frac{1}{2}$ per cent of gross receipts amounted to $14,636 in 1902, and $30,767 in 1907. Jersey City received in 1907 $3,700 from annual rental, $53,400 from percentage of earnings and $19,379 from property taxes. Other New Jersey cities collected in that year amounts varying from $3,511 percentage of receipts and $990 property taxes in Passaic to $10,799 percentage of receipts and $14,124 taxes in Trenton.

In New York City some street railways pay franchise taxes, but many do not, the franchises dating prior to 1884. The law passed that year requires companies to pay at least 3 per cent of their gross receipts during the first 5 years and 5 per cent thereafter. Franchises sold to the highest bidder have occasionally gone at a slight increase above this minimum, in one case 3 per cent above. Others require 4 per cent for 5 years, 6 per cent for the next 5, 8 per cent for the next, and 10 per cent for the last 10 years of the franchise period of 25 years. Some of the companies also pay $50 car license fees. In 1902 the total receipts of the city from these sources were $422,177. The following figures are for the year 1907 for the street and elevated roads paying franchise taxes; there are others which pay only license fees and regular taxes, and others only the regular taxes.

Brooklyn City Railroad had gross earnings from operation of 11,469,517.79 and paid franchise tax (F) of $143,580, car license (C) of $14,785, tax on earnings and capital stock (E) of $139,021.36, and tax on property used in the operation of the road (P) of $122,372.71.

The Brooklyn, Queens County & Suburban R. R. Co. had gross earnings of $1,586,507.05 and paid (F) $21,400, (C) $3,041.74, (E) $16,189.02 and (P) $9,600.

The Interborough Rapid Transit Co. had gross earnings of $22,363,802.33 and paid special franchise, personal, etc., taxes of $1,035,102.46; (E) $185,055.83 and (P) $157,806.08.

The Nassau Electric R. R. Co. had gross earnings of $3,167,61552 and paid (F) $60,000, (C) $7,211, (E) $58,945.17.

The total receipts of New York City, taken from the U. S. report for 1907, included $29,460 from car licenses, $9,585 annual rental of privileges and $313,997 percentage of earnings, which amounts do not agree exactly with the sums of the above, probably on account of differences in classification and fiscal year covered and receipts from other roads.

Rochester, N. Y., collects 1 per cent of gross receipts, amounting with a small car license fee to about $30,000 in 1902, although the total gross receipts did not much exceed $1,000,000.

In 1907 the receipts were $23,209 from percentage of earnings, $1,490 from licenses, $59,867 from tax of franchise and $7,865 from other taxes.

Buffalo collects 3 per cent of earnings, which was $85,851 in 1902, and $120,628 in 1907. In the latter year taxes amounting to $56,637 were also collected.

In 1907 Albany received $2,500 from sale of privileges to street car company and $274 percentage of earnings.

Cincinnati, O., collects 6 per cent of the gross receipts, which amounted to $200,000 in 1902, $240,141 in 1906 and $257,086 in 1907. In the latter year the city also collected $2,275 car license fees and $45,214 in regular taxes. Dayton collects $300 a year compensation for privileges, and in 1907 the percentage of earnings brought $14,940, and other taxes $20,535. Cleveland collected in 1907 $3,152 annual rental, $84,488 percentage of receipts, $8,740 license fees, and $135,520 other taxes.

Philadelphia, Pa., requires street railway companies to pave the whole street, and some companies pay a tax of 5 per cent on dividends in excess of 6 per cent. Car license fees of $50 a car amounted to about $100,000 in 1902. The total payments of one company averaged about 7 per cent of the gross receipts in 1900-1-2. Receipts in 1907 were $115,579 from percentage of receipts, $122,204 from car licenses. In Harrisburg the street railway company paid $14,671 in 1906, and $16,461 in 1907 percentage of receipts, and each year a $500 license fee.

Providence, R. I., receives 5 per cent on gross receipts, which amounted to $66,195 in 1902 and $78,103 in 1906. The company paid $38,253 regular taxes also in the latter year. In 1907 Providence collected $1,100 annual rental of franchise, $83,889 percentage on receipts and $60,552 regular taxes. Woonsocket, collecting 3 per cent, received $1,631 in 1902 and $1,231 in 1906, and also $1,231 of regular taxes.

Nashville, Tenn., receives 2 per cent of gross receipts up to $1,000,000 and 3 per cent thereafter. Its receipts in 1907 were $33,143 from the percentage of gross receipts from street railway and lighting company, $750 licenses and $60,160 taxes on property of company.

In 1907 Houston, Tex., received $6,791 percentage of gross receipts of street railroad company and $13,576 taxes on its property. Ft. Worth collected $1,132 percentage on receipts and $8,524 taxes on property.

Richmond, Va., collects 5 per cent of gross receipts, which amounted to $28,121 in 1902 on gross receipts of about $600,000. The collections in 1906 amounted to $13,940 on gross receipts, $1,600 on car licenses and $24,017 regular taxes; and in 1907, $40,452, $1,600 and $30,549 respectively. Norfolk levies 4 per cent on gross earnings, which tax amounted to $12,671 in 1902. In 1906 the collections were $1,000 fixed payment for franchise, $2,700 for licenses and $40,025 for taxes. In 1907 they were $23,813 percentage on receipts, $6,000 for licenses and $32,300 other taxes.

In 1907 Seattle, Wash., collected from street railways $10,000 from sale of privilege, $300 annual rental of privilege, $55,480 for percentage of gross earnings, and $59,781 from taxes. Tacoma collected $15,943 percentage of earnings and $12,012 taxes.

Montreal, Que., receives 20 per cent of gross receipts.

SPECIFICATIONS FOR LAYING BRICK PAVEMENTS.*

ALL brick must be strictly No. 1 pavers of the size commercially known as vitrified block, the width of which must not vary more than one-eighth of an inch.

They must be thoroughly annealed, tough and durable, regular in size, shape and evenly burned.

When broken the block shall show a dense, stonelike body, uniform in color inside, free from lumps of uncrushed clay, lime, air pockets, cracks or marked laminations, kiln marks or surface cracks must not exceed 3-16 of an inch in depth.

All blocks so distorted in burning as to lay unevenly in the pavement shall be rejected.

All blocks shall be tested for abrasion and absorption, the limits of loss by abrasion test and amount of absorption to be determined by the engineer in charge of the work.

The abrasion test shall be made with the rattler recommended by the National Paving Brick Manufacturers' Association and of the following shape and dimensions: A regular fourteen (14) sided polygon, circumscribed around a circle 28 inches in diameter

*Report of Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications.

and the barrel to be twenty inches long with one-quarter (¼) inch spaces between each side, and where cast-iron staves are used, the engineer in charge of the work shall require greater loss from abrasion than when steel is used.

Note.—In view of the fact that the National Paving Brick Makers' Association is now considering a modification as to dimensions and materials of the "rattler" now and for some time in use, your committee advise that questions touching the "rattler" be not considered until after the association have reached a conclusion and made a recommendation as to this appliance.

For the information of the convention we submit a tentative report on the "rattler" made by the National Paving Brick Makers' Association, together with plans and specifications for "rattler," and with the suggestions for tests.

All blocks shall be laid on a six-inch concrete base with sand cushion. The sand cushion shall be clean, sharp sand, spread to a uniform surface to conform to the cross-section of the finished pavement; the sand cushion to be slightly mostened and rolled with a hand roller weighing not less than ten pounds per inch of width. The depth of sand to be not less than 1½ inches nor more than 2 inches after rolling.

CEMENT FILLER FOR BRICK PAVEMENTS.

Your committee, after considering this matter carefully, beg leave to report the following and recommend its adoption:

The filler shall be composed of one part of clean, sharp sand and Portland cement. The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cement, shall be placed in the box and mixed dry until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

The sides and edges of the brick should be thoroughly wet before the filler is applied by being gently sprinkled.

From the time the water is applied until the last drop is removed and floated into the joints of the pavement, the mixture must be kept in constant motion.

The mixture must be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be four feet eight inches long, thirty inches wide and fourteen inches deep, resting on legs of different lengths, so that the mixture will read-bottom of which should be six inches above the pavement. This mixture, from the moment it touches the brick, should be thoroughly swept into the joints.

Two such boxes shall be provided in case the street is twenty feet or less in width; exceeding twenty feet in width, three boxes should be used.

The work of filling should thus be carried forward in line until an advance of fifteen to twenty yards has been laid, when the same force and appliances shall be turned back and cover the same space in like manner, except to make the proportions two-thirds Portland cement and one-third sand.

To avoid the possibility of thickening at any point, there should be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, briging them up flush and full.

Note.—Where a stronger filler is desired pure cement may be used.

After the joints are thus filled flush with the top of the brick and sufficient time for hardening has elapsed, so that the coating of sand will not absorb any moisture from the cement mixture, one-half inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

Note.—Where streets cannot be kept closed long enough to permit cement grout to properly set, or on account of any other local conditions, a bituminous filler may be used.

After brick in pavements are inspected and the surface is swept clean the pavement shall then be rolled with a roller weighing not less than three nor more than five tons in the following manner: The brick next the curb should be tamped with a hardwood tamper to the proper grade. The rolling will then commence near the curb at a very slow pace and continue back and forth towards the center, until the center of the street is reached, then passing to opposite curb and repeat in the same manner to the center of the street. After this first passing of the roller the pace may be quickened and the rolling continued until each brick

is firmly imbedded in the sand cushion. The pavement shall be rolled transversely at an angle of 45 degrees from curb to curb, repeating the rolling in opposite forty-five-degree direction. Before and after this transverse rolling has taken place, all broken or injured blocks must be taken up and replaced with perfect ones. The substituted blocks must be brought to the true surface by tamping.

Expansion joints shall be placed parallel with and at each of the curb lines and shall not be less than one inch in width. Said joints shall be filled completely with bituminous cement.

SPECIFICATIONS FOR GRANITE PAVING BLOCKS.*

YOUR committee in considering this question decided at this time to only recommend certain dimensions and features in regard to the blocks themselves, rather than a complete set of specifications for this form of pavement.

It is believed that the adoption of certain standard dimensions for the blocks will result in having the several quarries improve the output of paving blocks and enable them to furnish a standard block more expeditiously, and it is hoped, at not to exceed the cost which now maintains.

DIMENSIONS OF BLOCKS.

First. It is recommended that the depth of block be five inches, with an allowable variation of one-quarter inch greater or less in said depth.

Second. The blocks shall be so dressed that they can be laid with one-half-inch joint for a distance of one inch down from the head, the individual joints to be measured. The joint not to exceed one-half inch at the top nor to be more than one inch in any part of the joint.

Third. The block to be from eight inches to twelve inches in length.

Fourth. The block to be from three and one-half inches to four and one-half inches in width for ordinary conditions, with a suggestion of greater width to be allowed for streets of flat grades; said width to be specified in each individual contract.

Fifth. The head of the block shall be so dressed that it shall not have more than three-eighths-inch depression from a straight edge laid in any direction across the head and held parallel to the general surface of teh block.

*Report of Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications.

SPECIFICATIONS FOR MACADAM PAVEMENTS.*

INASMUCH as macadam is one of the lowest classes of pavement and one of the most cheaply constructed, the general tendency seems to have been to pass over the specifications for its construction hurriedly, and on the part of many engineers and city officials not nearly enough attention has been paid to details. The successful use of crushed rock as a paving material depends altogether on this same attention to detail.

While in the construction of any class or type of paving local conditions of weather and traffic largely govern, it is in the construction of macadam pavements that the engineer must give greatest weight to surrounding circumstances. The kind and condition of the soil, the character and quality of the stone, the class and the volume of traffic, must all be closely scrutinized and carefully considered in the preparation of specifications if first-class macadam construction is to result.

In some localities a Telford foundation is better, and in others the macadam is considered superior. To meet the individual preferences of road builders your committee has prepared specifications covering both forms.

Your committee unanimously concurs in the belief that a modern macadam pavement can hardly be considered finished until it has been given some binding treatment, and the specification has been prepared with an ultimate treatment with some bituminous compound in view. We have considered treatment by penetration only, however, as other methods would more properly come before your committee on asphalt and bituminous macadam.

In the limited time at the disposal of

*Report of Committee on Macadam of the Organization for Standardizing Paving Specifications.

your committee it has been impossible to go fully into the merits of the various tars and bitumens offered by the manufacturers for macadam road treatment. In this specification we have endeavored to indicate a method of application which would generally be attended with successful results. However, in the use of these materials it is recommended that the engineers consult with the manufacturers and so amend this specification that it will comply with their requirements.

It is further recommended that careful consideration be given the physical and chemical requirements of the bituminous treatment and that they be specified by such requirements rather than by trade names.

SUB-GRADE.

The portion of the roadway indicated shall be excavated from the present surface thereof to a sub-grade, which, when properly prepared, in the case of Telford foundation, shall be 14 inches and in macadam foundation shall be 12 inches, below and parallel with the surface of the completed pavement. Said completed surface shall conform to the general cross-section of the street as indicated, and shall be thoroughly cleared, all stumps, roots and sod or other vegetable matter removed, and the sub-grade shall be rolled with a steam road roller weighing ten tons, so the surface shall be exactly parallel with the proposed finished surface. All soft or spongy places shall be excavated and refilled solidly with gravel, broken stone or approved earth before the completion of the rolling. If, by reason of steep grades or other circumstances, it is deemed impracticable to use the steam road roller, the contractor will be permitted to use an approved horse roller upon application to and with the consent of the proper authority.

TELFORD FOUNDATION.

Upon the sub-grade thus prepared, rolled and accepted, there shall be placed a foundation of clean, hard, sound stone, broken into sizes which shall come within the following dimensions: Four to eight inches in width, eight to fourteen inches in length, and not less than eight inches in depth. The stone shall be placed by hand vertically upon the broad edge and lengthwise across the roadway, so as to form a close, firm foundation from gutter to gutter. The projection of the stones above and below surface eight inches above the sub-grade shall be broken off with napping hammers and the pieces so broken off, together with other stones of suitable size and shape, shall be used as wedges to firmly fix the stone of the foundation in proper position, so that its top surface will be parallel to the sub-grade of the roadway and eight inches above it.

Upon the roadway thus prepared there shall be spread a layer of good, clean earth, preferably clayey loam, not to exceed one inch in thickness. The foundation shall then be thoroughly rolled with a steam road roller weighing not less than ten tons. In places where rolling is impracticable, the foundation shall be rammed with suitable rammers, with the approval of the proper authorities.

MACADAM FOUNDATION.

Upon the sub-grade prepared in the manner above described shall be spread a layer of broken stone which, when thoroughly compacted as herein provided, shall be not less than six inches in depth. The stone in this layer shall be practically uniform in quality and as near an approach to a cube as possible, and broken so that its greatest dimension shall not exceed four inches and the smallest dimension not less than two inches; all to be free from dust, dirt and screenings. All stones which do not approach uniformity of measurement shall be rejected and removed from the roadbed. No stones shall be allowed to remain which are not sound, strong and equable in size and quality. This layer of stone shall be thoroughly rolled with a steam road roller weighing not less than ten tons without the application of water.

SECOND COURSE

Upon the above described foundation shall be placed a layer of broken stone whose greatest dimension shall not exceed two inches and the least dimension shall not be less than three-fourths of an inch, to a depth which, when compacted as herein specified, shall be four inches. This stone shall be thoroughly rolled with a ten-ton steam road roller and sufficient clean stone screenings and water shall be spread over its surface to afford, when the rolling is completed, a practically smooth, dense and hard surface. When the second course as herein specified is completed there shall be spread upon it a layer of stone ranging in size from one inch to one-half inch in the greatest dimension, which, when compacted, shall be two inches in depth. This latter shall be thoroughly rolled and compacted with the ten-ton roller without the application of water until the stone ceases to

creep before the rolls of the machine. The rolling herein specified must be generally begun at the curb or gutter line and rolled from curb to crown, the shoulders first being rolled so as to prevent the spreading of the stone.

BITUMINOUS FILLER.

After the macadam pavement, as above specified shall have been thoroughly rolled and when it is in a bone-dry condition, it is to receive a bituminous treatment applied as follows: The surface must be clean, free from dust, dirt or foreign matter, the bitumen applied in an approved manner and at a temperature of not less than .... degrees Fahrenheit and in sufficient quantity to cover all parts of the surface and in quantity not less than one and one-half gallons and not more than two gallons to a square yard of surface. After the application of the bitumen and after it has had time to set, there shall be applied a coating of clean stone chips whose greatest dimension shall not exceed one-half inch and whose smallest dimension shall be no less than one-fourth inch, sufficient to absorb all of the excess of bitumen, and the whole shall be rolled and re-rolled until it presents a smooth, hard, dense and granular surface.

BONDS AND GUARANTEES FOR PAVEMENTS.*

THE committee finds upon examination among its members and from conference with other delegates, that the practice of providing for the maintenance of pavements upon completion and requiring a guarantee to insure the faithful execution of the obligation is common to all the cities.

The period of such maintenance and the methods of guarantee are widely different. Ten years of maintenance are still insisted upon in some cities for all classes of pavements, five years for soft pavements and three years and one year for the hard pavements are required in others, and in the city of Baltimore City Engineer Fendall has recommended to his City Council, without the prospects of adoption, that maintenance periods be eliminated altogether from their contracts, because he believes that unnecessary amounts are being paid out for maintenance, and that it is practicable to establish and operate a system of inspection that will afford every reasonable and necessary assurance that the contract in all respects, both as to materials and labor, has been properly executed.

The usual practice to insure the faithful performance of the contract to maintain the pavement for a given period is to resort to a guarantee bond. In the majority of cases this bond is required to be that of a bonding company, although since the bonding companies have declined to write ten-year risks, those cities asking for ten-year guarantees have been obliged to accept personal bonds for five years of the period.

Until recently this practice was general, but experiences related by several of the cities and referred to hereinafter, have lead to the adoption in some cases of a further safeguard to insure the maintenance of the pavements.

This further safeguard is the requirement that at the close of the construction work there shall be left with the city a cash deposit or its equivalent, which may be used for the purpose of making repairs in case the contractor fails from any cause to meet his obligation during the life of his contract. The money is to be returned during or at the expiration of the period, provided the contract has been fulfilled.

In some cases, in fact, the majority of cases, brought to our attention, both the cash reserve and the guarantee bond are required to be given, with the object of doubly insuring the proper maintenance. In New Orleans alone for the past year and a half the use of maintenance bonds has been abandoned because in every case of default it was not possible to recover on the bond, and instead a cash reservation, equal to 15 cents per square yard in the residential districts and 25 cents per square yard in the business districts, has been made to guarantee the maintenance.

Taking into consideration all the facts brought to our attention, we have concluded to make the following recommendations:

First. That all pavements, any portion of which is constructed of materials of a perishable nature, among which we would include asphalt, bitulithic or bituminous macadam and wood block, or other pavement requir-

*Report of Committee of the Organization for Standardizing Paving Specifications.

I. COURT STREET MEDINA BLOCK STONE PAVEMENT, ROCHESTER, N. Y.

ing special equipment to lay and maintain, and also such pavements as are of a patent or proprietary nature, new or more or less experimental in character, shall be required to be maintained for a period of five (5) years from the first day of July next following completion.

Second. That all pavements composed of materials more durable in character, among which we would include stone block, vitrified brick and well-established Portland cement concrete pavements, shall be required to be maintained for a period of one (1) year from the first day of July next following the completion.

Third. That in the case of all pavements a cash deposit, or its equivalent, of ten (10) per cent. of the contract price per square yard for each square yard of pavement be retained for the whole of the maintenance period, said sum, with its accumulations, if any, to be paid in full to the contractor if he fulfills the terms of his guarantee. The reservation is to be subject, however, during the maintenance period, for use by the city in making such repairs as are necessary and have been neglected or ignored by the contractor. In the latter case the balance of the fund, if any, shall be returned to the contractor at the end of the maintenance period.

Fourth. We further recommend that if the bonding companies will offer a uniform and standard form of guarantee, satisfactory in form and cost to the cities, members of this association, which will protect the cities as amply and accomplish the purpose of keeping the pavements in repair as fully as may be done by the cash reserve plan, a guarantee bond in twice the amount of the established cash reserve be accepted in lieu thereof.

Fifth. In case of the satisfactory adjustment in the guarantee plan and its adoption by this association, it is further recommended that any default on the part of any bonding company in any of the cities of this association shall be reported to its secretary, and it shall be his duty to report to each of the said cities on account of such default.

Our conclusions with respect to the period of maintenance for pavements like asphalt are based on the theory of the execution of the construction under specifications permitting the contractor to use his own judgment between certain limits in manufacturing the pavement, thus assuming to himself the responsibility and risk of its success and relieving the city therefrom.

If it is the determination of the convention to adopt close-drawn specifications for asphalt and similar pavements, taking over to the city the full responsibility for the manufacture and construction of the pavement, our views upon this subject will have to be modified.

We offer in explanation of our recommendations the following reasons:

We recommend in the case of the so-called soft pavements a maintenance period of five (5) years.

First. Because it is deemed necessary on account of the nature of the materials used and the method of manufacture to require that length of time to fully demonstrate that the original work was executed strictly in accordance with the specifications and to develop defects in materials or workmanship.

Second. Because of the variation in the sizes and resources of the several cities interested and the impracticability of establishing and maintaining in each the expert, technical and practical service, as well as the special apparatus and equipment to properly inspect an original construction and subsequently maintain it.

Third. Because a longer period is not required for any practical purpose and imposes on the taxpayer in advance the cost of maintaining the pavement during a period too remote and under conditions too speculative to permit a proper estimate of the cost to be made in advance.

It is believed by your committee to be a better business proposition to save to the taxpayer the money which may be required for maintenance subsequent to five (5) years until it is demonstrated that it is needed for the purpose.

We recommend in the case of the more durable pavements a maintenance period of one (1) year only.

First. Because the nature of the materials used and the work of construction are easily and readily specified and inspected, and all defects of workmanship and material will be developed in the period recommended.

Second. Because the materials required for repairs may be purchased in the open market under competition, and the work done with the ordinary tools and appliances and skilled labor at hand.

Third. Because the repairs required upon this class of pavement amount to little or nothing during a number of years of its life, in fact and as a rule, none until such time as the whole surface is in a condition to require re-

II. CLINTON AVENUE, SOUTH, ASPHALT AND WOOD BLOCK PAVEMENT, ROCHESTER, N. Y.

paving. The taxpayer may as well be saved the expense imposed by a requirement to maintain from which he obtains no service or other return.

We recommend the adoption of a cash reserve in place of the present bonds written by the bonding companies, and in place of the double provision of a cash reserve together with a like bond.

First. Because in the first of the above instances it has been brought to our attention that in several of the cities consulted some of the bonding companies have refused to make good the default of the contractor, and upon the expenditure of the money by the city pursuant to the terms of its contract to carry out its provisions have contested the demand of the city to be reimbursed and demonstrated in court the insufficiency of its guarantee by its success in the proceeding.

We believe that the cost of the guarantee by means of the cash reserve will be less than that required to provide a guarantee bond, and that the difference should be saved to the taxpayer. Again, it is essential and of prime importance that repairs should be made when they are needed, and by the adoption of a cash reserve scheme this object may be accomplished, and law suits, if they must come, carried on while the pavement is in good and safe condition.

Second. Because in the second of the above instances if the cash reserve scheme is sufficient to accomplish the desired object of keeping the pavement in good repair for the period specified, and we believe it is, the further requirement of furnishing the bond is superfluous and adds just so much unnecessary cost to the work and to the taxpayer, and consequently should be dispensed with.

Your committee believes that there should be a more definite determination of conditions to be fulfilled under the maintenance and its guarantee. Such requirement should be special for the various kinds of pavements, but should be definite as to the condition requisite for the acceptance of the work and release of the guarantee.

PUBLIC IMPROVEMENTS IN ROCHESTER, N. Y.

FOR the accompanying photographs and for the information regarding the improvements shown in them we are indebted to Mr. E. A. Fisher, the city engineer of Rochester, whose efficiency is shown by his continuance in office through many changes in administration, and who is responsible for the excellent quality of the work.

The first plate shows a Medina block stone pavement laid on Court street in 1907. The Medina block stone pavement is one which originated in Rochester. It is of the same sandstone of which many streets have been laid in this and other cities, but the blocks have been carefully dressed until they can be laid with narrow joints and a surface almost as smooth as a brick pavement. Care being taken to select blocks of uniform texture and hardness, the pavement retains its good qualities almost indefinitely.

Several short pavements of the same sort have been laid on this street, ranging in price from $3.50 a square yard for one laid in 1894, to $2.60 in 1897 and $2.80 for that shown. The pavements are laid on 6-inch concrete foundation, the earlier ones having a pitch filler and the latest cement grout. The street is 29 feet between curbs. The street railway track is laid on wooden ties set on concrete and the track is 93-pound 8¾-inch step rail. The cost of the pavement of the track was $2.90 per square yard.

The second plate shows Clinton avenue, south, which was finished in December, 1906. This entire pavement was paid for by the street railway company. It is composed of asphalt on the driveways, wooden block between the rails and tracks and a small amount, about 5 per cent of the total area, of Medina stone block. The construction of street car track is the same as on Court street, except that the rail is a 104-pound 9-inch girder. The asphalt pavement cost $2 a square yard, the wood block $3.40, and the Medina block $2.15.

The third photograph shows the Field street brick pavement, a half mile long and 26 feet wide, completed in 1907. The pavement was laid on 6-inch concrete foundation with Calder brick, cement grout filler and expansion joints of pitch. It cost $2 a square yard with a 10-year guaranty.

III. FIELD STREET BRICK PAVEMENT, ROCHESTER, N. Y.

RATES FOR TUNGSTEN STREET LAMPS.

By Alton D. Adams, Rochester, N. Y.

TUNGSTEN lamps have displaced the majority of the carbon incandescents and also many arcs on the streets, to the extent of more than thirteen thousand in a single state.

No less than 26 cities and towns in this same state have more than 200 tungsten street lamps each, eight municipalities have more than 500 of these lamps respectively, and one city has 1,157 such lamps.

This extensive use of tungsten lamps has created a new situation as to rates for street lighting, owing to the fact that the tungsten filament requires only 36 per cent as much energy per candle power as the regular 3.5-watt carbon, to the higher renewal cost of the tungsten lamps, and to the investment in new fixtures where these lamps are installed.

Though the 40-and 60-candle power series tungsten lamps sell at the same price, and the 80 candle size costs only 20 cents more, the majority of the tungsten street lamps installed are unfortunately of 40 candle power. Thus in the state under consideration only three cities had more than 200 tungsten lamps of 60 candle power, and the 80 and 100 c.p. sizes are used there to only a small extent.

In one town of the state there are 23 of the 200 candle power series tungsten lamps on the street, and a few are found in other places. Much the greater number of the tungsten lamps are operated with 6.6 amperes, but the 40-candle size is found on circuits that carry 1.5 to 7.5 amperes.

With the higher candle powers and much higher efficiency of the tungsten lamps there have come some changes in the rates per lamp-year and lamp-hour, and a much greater change in the rates per kilowatt hour for energy used at the street lamps. Looking over a list of some fifty cities and towns using tungsten street lamps in the state under consideration, the rates per kilowatt hour on the basis of the energy consumed in the lamps range from as much as 20 cents down to 5.06 cents. The rate of 20 cents per kilowatt hour applies in a town where 232 lamps of 40 candle power are operated 1,440 hours per year at the price of $14.40 each, or one cent per lamp-hour. For the rate of 5.06 cents per kilowatt hour seventy lamps of 60 candle power were operated 3,965 hours at the yearly rate of $15.00 each, or 0.38 cent per lamp-hour. Between these extremes a great part of the tungsten street lighting is done at rates from about 7 to 12 cents per kilowatt hour on the basis of the energy used in the lamps at normal rating.

SOME TUNGSTEN STREET LAMPS IN CITIES AND TOWNS OF ONE STATE.

Number of Lamps in City or Town	C. P.	Yearly Hour	$ Yearly Rate	Cents per Lamp-Hour	Cents per K. W. H.
210	40	1,512	14.58	0.96	19.2
215	40	1,524	14.61	0.95	19.0
231	40	1,548	14.67	0.94	18.8
232	40	1,440	14.40	1.00	20.0
245	40	2,979	17.00	0.57	11.4
269	40	2,293	16.53	0.72	14.4
284	40	1,607	14.81	0.92	18.4
284	40	2,412	16.83	0.70	14.0
334	40	3,965	15.00	0.38	7.60
336	40	2,164	19.00	0.87	17.4
351	40	2,215	18.00	0.81	16.2
421	40	3,009	18.32	0.608	12.1
500	40	3,900	25.00	0.64	12.8
518	40	1,619	14.84	0.916	18.3
556	40	2,263	16.32	0.72	14.4
558	40	3,898	22.50	0.57	11.40
572	60	3,828	23.40	0.613	7.66
325	40	2,457	17.50	0.71	12.2
270	60	2,457	17.50	0.71	9.4
637	40	1,706	15.00	0.87	17.4
659	40	3,827	20.36	0.53	10.6
704	60	2,842	20.53	0.72	9.6
1157	40	3,049	18.75	0.61	12.2

The accompanying table shows the numbers, candle powers, hours of annual operation and rates for tungsten street lamps in twenty-two cities and towns of the state under consideration that contain more than 200 such lamps each. Several municipalities that operate more than 200 tungsten street lamps are not included in the table, because no definite rate could be named for the service.

It is to be noted that the higher rates per lamp-hour and per kilowatt-hour go in the main with the short hours of annual operation, say under

2,000, while the lower rates per lamp-hour correspond with 3,800 to 4,000 hours of lighting, and with the use of 60 candle power rather than 40 candle power lamps.

Thus in the six towns where the annual hours of operation were under 1,700 the range of rates was 18.3 cts. to 20 cts. per kilowatt-hour, with 40 candle power lamps. On the other hand, in the four places where 40 candle power lamps were operated more than 3,800 hours per year the rates per kilowatt-hour were 7.6 to 12.8 cents per kilowatt-hour. For the three groups of 60 candle power lamps the rates were 7.66 cents to 9.6 cents per kilowatt-hour with lighting hours of 2,457 to 3,828. Per hour of lighting, the 40 candle power lamps cost 0.38 to 1.00 cents, and the 60 candle power lamps 0.61 to 0.72 cent.

The lower rates go with the longer hours of lighting rather than with the larger numbers of lamps per city.

A company that operates thousands of tungsten street lamps in about a score of cities and towns has adopted a uniform method of charging for this service, the basis being a fixed yearly rate per lamp plus an additional amount for each hour of operation.

The large number of municipalities and street lamps to which these tungsten rates apply makes them of especial interest, and the following analysis is therefore presented. For the several candle powers the base rates are as follows, the fixed rate for each lamp applying without regard to the number of hours that the lamp is operated.

C. P. of Lamp	Fixed Rate per Lamp-Year	Operating Rate per Lamp-Hour
40	$10.80	0.25 cent
60	12.00	0.30 cent
80	14.00	0.40 cent
100	18.00	0.50 cent

It is evident that this method of charging is intended to give a certain return on the investment independent of the hours of lighting, and that the total rates per lamp-hour grow rapidly less for longer service. This is shown in the following table that gives the total rates per lamp-hour, from 1,000 to 4,000 hours yearly. For the 40 candle power lamp the total rate per hour for 1,000 hours of operation yearly is 1.33 cents, while for 4,000 hours of operation the total rate is only 0.52 cent, or 46 per cent of the former. A similar relation holds for each of the other candle powers.

TOTAL CENTS PER LAMP-HOUR FOR EACH CANDLE POWER.

Hours of Operation Yearly	40 C. P.	60 C. P.	80 C. P.	100 C. P.
1,000	1.33	1.50	1.80	2.30
1,500	0.97	1.10	1.33	1.70
2,000	0.79	0.90	1.10	1.40
2,500	0.682	0.78	0.96	1.22
3,000	0.61	0.70	0.886	1.10
4,000	0.52	0.60	0.75	0.95

As the rate per hour for operation is constant with each size of lamp, the lower total rates with long hours are due to the reduction of fixed charge per lamp-hour. This fixed charge per lamp-hour obviously varies inversely as the hours of operation, being only one-fourth as great in each case with 4,000 as with 1,000 hours of annual lighting.

With only 1,000 hours of lighting per year, the fixed rate amounts to about 80 per cent of the total rate per lamp-hour, being 1.2 cents out of 1.5 cents with the 60 candle size. For 4,000 hours of lighting annually, however, the fixed rate becomes approximately equal to the charge for operation per lamp-hour. Thus with the 60 candle power lamp lighted 4,000 hours per year, the fixed rate and the rate for operation are each 0.3 cent per lamp-hour.

If the total rate for the service is stated as a price per kilowatt-hour for the normal consumption of energy in the lamps, the kilowatt-hour rate goes up on the short hour service, but falls off rapidly with long hours. This result is exhibited in the following table, giving cents per kilowatt-hour, with 1,000, 2,500 and 4,000 hours' operation.

Hours	Cts. 40 C. P.	Cts. 60 C. P.	Cts. 80 C. P.	Cts. 100 C. P.
1,000	26.6	20.0	18.0	18.4
2,500	13.6	12.0	9.6	9.7
4,000	10.4	8.0	7.5	7.6

For the 40 candle power lamp the total rate amounts to 26.6 cents per kilowatt-hour, with 1,000 hours of annual lighting, and to 10.4 cents with 4,000 lighting hours. With the 80 candle power lamp the corresponding figure is 18.0 cents per kilowatt-hour for 1,000 hours of lighting, and 7.5 cents per kilowatt-hour for 4,000 lighting hours.

Total rates per lamp-year are exhibited in the following table, for 1,000 to 4,000 hours of lighting.

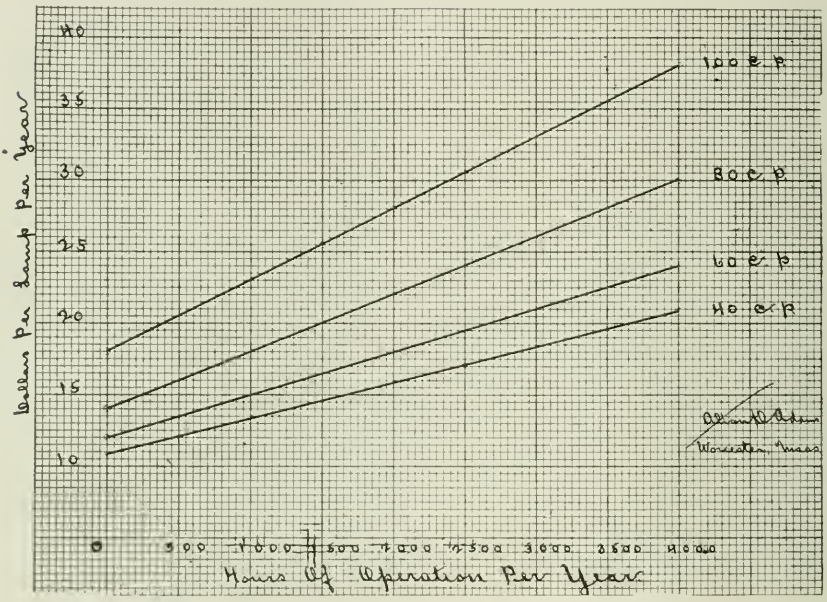
Hours Operated Yearly	40 C. P.	60 C. P.	80 C. P.	100 C.P.
	$	$	$	$
1,000	13.30	15.00	18.00	23.00
1,500	14.55	16.50	20.00	25.50
2,000	15.80	18.00	22.00	28.00
2,500	17.05	19.50	24.00	30.50
3,000	18.30	21.00	26.00	23.00
4,000	20.80	24.00	30.00	38.00

Comparing the annual rates with 1,000 hours of lighting and the annual rates with 4,000 hours, it will be noted that the latter are 56 per cent higher in case of the 40 candle power lamp, and 60 to 66 per cent higher for each of the other three sizes.

While as little as 1,000 hours of street lighting annually is found only in exceptional instances, 1,500-hour lighting is common on short moon schedules, while 2,500 hours is the approximate duration of half-night operation on every day of the year. Full all-night and every night lighting amounts to about 4,000 hours.

As shown in the table, the total annual rate for a 40-candle power lamp is $14.55 when burned 1,500 hours, and $20.80 when burned 4,000 hours. For a 100-candle power lamp the 1,000-hour rate is $23.00 and the 4,000-hour rate, $38.00.

The accompanying diagram is constructed on the basis of the table of total annual rates, and brings out more clearly the moderate increase of rate with long-hour lighting, and the relative rates for the several sizes of lamps. Reduced to figures, the annual rates for the larger lamps as percentages of the 40-candle power rates are as follows.



Hours Lighted Annually	40 C. P. Rate Per Ct.	60 C. P. Rate % 40 C.P.	80 C. P. Rate % 40 C.P.	100 C. P. Rate % of 40 C.P. Rate
2,500	100	115	140	178
4,000	100	115	144	182

For full half-night and all-night lighting, it thus appears that the 40-candle power light may be increased 50 per cent for a 15 per cent higher rate, and 100 per cent for a 40 to 44 per cent higher rate.

EDITORIAL COMMENT

A National Department of Public Health—Uniform Accounts and Reports—Standard Paving Specifications — Co-operative Franchises for Municipal Public Service Corporations — Legislation Concerning Licensing of Engineers.

A NATIONAL DEPARTMENT OF PUBLIC HEALTH.

A bill has been introduced in the United States Senate which, in effect, proposes to elevate the Marine Hospital service to the dignity of a separate department, whose head shall be a cabinet officer, and to transfer to this department all the sanitary and health activities of the various departments except possibly the detail of the hospital service of the army.

Were the effect of the bill simply to recognize in this most pronounced way the efficient service of this bureau the bill could scarcely be supported. But the importance of proper control of many agencies inimical to health is now more fully recognized than ever before and the necessity that this control shall be expert is self-evident. At present several departments have been obliged to pay greater or less attention to health and sanitation on account of the demands of their service, but the result has been more or less unsatisfactory, except where it has been possible to press the Marine Hospital organization into the service.

There have been numerous deplorable occurrences on account of the division of responsibility on such matters, the administration of laws by ignorant officials unable to make proper distinctions, the suppression of efficient workers in sanitation by superiors interested in the business rather than the sanitary effects. To mention but two of widely different natures: The detention of a wealthy foreigner going to Arizona for treatment for tuberculosis, as though he were an ignorant and indigent immigrant; and the suppression of news and denial of the bubonic plague at certain ports, resulting in wide spread of the disease.

Then there are interstate matters of sanitation connected with transportation, pollution of streams, and the like, which require treatment by a department which is devoted to this duty, and is not a subordinate bureau in a department which may be interested in nullifying the efforts of the health bureau, or may be accused by other departments of interfering in their work.

The importance of the sanitary work of the country at large is rapidly becoming great enough to warrant the erection of its organization into a department co-ordinate with the other great departments of the government, and if this fact is not recognized by the present Congress it will be by another in the near futere.

UNIFORM ACCOUNTS AND REPORTS.

The report of the committee of the American Water Works Association on a uniform system of accounts and reports for water supply enterprises, made to the New Orleans convention, is the most complete treatment of this subject which has yet appeared. The details are worked out for the items of water works systems, but the general plan can be used for any public service industry which is required to make periodical reports or which desires to be able to compare its cost of operation for various periods and to know what its financial status is at any given time. The report covers 326 pages and is printed in separate form that it may be used by all those interested in the subject. A general conference of representatives of all interested bodies of men is proposed, and this report will form a most satisfactory basis for the discussions at such a conference.

The report seems to be built on large enough scale to cover the most extensive water works system, but need not on that account frighten the superintendent of the small plant, for by a process of elimination of items not included in his system and combination of items not important enough in his system to warrant separate accounts, he can follow the plan of the report and gain all of its advantages in the way of ability to analyze the operations of his plant and to make the uniform reports, more of which are demanded each year by the legislation of the various states.

Indeed much of this elimination and combination is already done for him by such publications as the American

Water Works Standard Bookkeeping System, which is built on the same lines followed in the committee's report. The divisions of the report consider in full detail the terminology of balance-sheet accounts, of revenue and expense accounts, the requisites of a system of uniform accounts and its use, general rules and instructions for installing a system, the classification of accounts and instructions concerning treatment of fixed assets, floating and nominal assets, liabilities, proprietary interests, operating revenues, operating expenses, miscellaneous revenues and expenses, all carried to all the details found in any existing plant, instructions for profit and loss allocation, and a form of annual report of water works schedule.

The last named form is somewhat more detailed than the form which has been used heretofore and supplies very satisfactorily the omissions from that form, particularly as to assets and liabilities, profit and loss, cost of system, details of pumping and purification plants and details in items of revenue and expense.

The report marks a distinct advance in the discussion of this question and deserves adoption by all the bodies interested practically in the form in which it is presented.

It may well serve as a model for work on the accounts and reports of other public service industries.

LEGISLATION CONCERNING LICENSING OF ENGINEERS.

The introduction of a bill in the New York Legislature which proposes to license civil engineers in that State and the request from the legislator introducing the bill for the support of the American Society of Civil Engineers has forced upon that body the consideration of a subject which has heretofore been sidetracked whenever it has been brought up by any interested member.

Withdrawal of the bill for a time to permit closer consideration of the subject has been secured, but the matter must be considered promptly if the legislation of the State is to be guided in any measure by those most directly interested in it.

The editorial on "Qualifications of Engineers and How to Determine Them" in the April number of Municipal Engineering suggests a method which is perfectly feasible, is a protective measure for the State and the municipalities and counties within its borders and can not be objected to by anyone not serving such corporations in a technical capacity.

The plan may be stated in a little greater detail as an organization for determining the qualifications of engineers seeking employment from state, county, city or board having charge of public construction work, and fixing the minimum of such qualifications necessary to authorize the administrative officers to employ such applicants or engineers to whom they may offer employment.

The character of the machinery for carrying on this work must be determined according to the necessities of the case in any given state. In New York, where there are great engineering organizations within the great city and other great engineering organizations in charge of state boards and departments, there must be a more flexible central organization than in a state where the engineering work is less extensive and the principal offices to be filled are those of city and county engineer and their subordinates, and an occasional engineer of a state or county or city board.

A state board of examiners of engineers is the most obvious director of such an organization, and it should be given considerable leeway, although some restrictions upon its action would undoubtedly be desirable. It is only intended here to suggest this protective measure for the State as the one most easily defended, the one most readily carried through the legislature.

The adoption of such a plan would have a most salutary effect upon the engineering profession in general. If the methods of putting names of competent engineers on the lists for the various grades of appointments are as good as they should be the certificate of eligibility will be the best evidence an engineer can have of his technical standing, and the state's examination will be taken by many who do not expect to seek public employment, simply that they may have the certificates of attainment. Employers will soon come to demand such certificates as evidence of competence. Such voluntary examinations as have been devised by organizations of engineers in England show that this will be the effect. The only problem is to secure a competent examining board with a reasonable set of instructions by the legislature.

CO-OPERATIVE FRANCHISES FOR MUNICIPAL PUBLIC SERVICE CORPORATIONS.

The attempts to secure co-operative franchises for municipal public service corporations are becoming numerous enough to be noticeable. Unfortunately they are up to this time unsuccessful attempts and we have as yet no practical trial to show what their success may be.

The first is one presented by the water company at Lake Forest, Ill., based on suggestions made by the mayor of Lake Forest, which were elaborated and added to by the attorney and the engineer of the water company. Mr. J. W. Alvord, in a paper on "A Co-Operative Water Works Franchise," before the American Water Works Association at its New Orleans convention, gives the terms of the proposed ordinance. The reason he gives for the failure of the council to pass the ordinance, although the city officials suggested its principal terms, is that some increase in water rates would doubtless be made by the appraisers and the council has not seen fit to initiate a proceeding which would have this result.

The second proposed ordinance is one, the terms for which were suggested to the city of Champaign, Ill., also for a water company, by Dabney H. Maury of Peoria. Mr. Maury presented these recommendations in a paper before the Indiana Sanitary and Water Supply Association a year or more ago, which paper is printed in MUNICIPAL ENGINEERING, vol. xxxvi, p. 247, to which reference may be made for the details of the new terms proposed. This proposition seems to have dropped out of consideration without arriving at any definite stage of discussion between council and company.

The third proposed ordinance is one presented by the Commercial Club of Crawfordsville, Ind., to the city council, together with the agreement and bond of one of the companies to accept the ordinance if passed; the desire being to unite the two telephonic services of the town and their long-distance connections into one. This ordinance is given in whole or in part in papers presented by Charles Carroll Brown of Indianapolis to the American Society of Municipal Improvements and to the Indiana Engineering Society. It was rejected by the city council because that body, according to statements of its members, feared it would not produce the desired consolidation.

It is thus seen that, as shown by the record, the principal difficulty in the way of the adoption of this modern form franchise, which substitutes definite, equitable, adjustable terms for the former indefinite franchises, is in the city councils and not in the companies. What this means it is difficult to say. Each of the councils named has had the benefit of expert legal and engineering advice, the ordinances having been actually prepared by such men, in one case, in the employ of the company, in the second of the city, and in the third of a disinterested committee of the leading business men. If the city officials could place their confidence in anyone it would seem that they could accept the judgments thus formed and presented to them.

Definite reasonable returns on the capital actually invested in the plants were provided for, and the methods of determining what the rates should be to produce these returns were minutely detailed, with ample provision of checks and publicity as preventives of dishonesty and injustice to either party. In two cases at least the rates were none too high, and the knowledge of this fact probably prevented action by one council, as above stated, and possibly by the other, although no such reason for the rejection of the ordinance was given. It would not be fair in any of these cases to suspect any ulterior motive, although such suspicion may arise in the minds of those who do not know the circumstances in the various cases. The most obvious explanation to one who has had experience with city councils, especially in the smaller cities, is that the proposals are so new in form that the inertia of council-manic ignorance was greater than the influences brought to bear in favor of the change. In at least one case this inertia was aided by the active opposition of a few persons whose interests would be affected by the passage of the proposed ordinance.

In the state public service commission lies the logical control of municipal public service corporations under both public and private ownership, but neither Illinois nor Indiana has such a commission nor any prospect of the early establishment of one. The co-operative franchise is therefore simply a temporary expedient for use where it can be secured until the better system is adopted. The machinery required for carrying out the purposes of the ordinance requires expert handling to secure good results and the small city has such experts at home only by the merest chance, and is likely to object to the expense of bringing them in

from outside. The state commission, on the other hand, has business enough to warrant the employment of the highest class of expert assistants and can keep them busy all the time. The best possible results can therefore be obtained at a low percentage of cost on the interests involved.

The Illinois legislature has attempted to supply the lack of a state commission by tacking the duties of such a commission on a similar body for each city in its bill providing for a commission form of government for its cities, but this application of force to the control of the public service corporations is on a far different basis from the proposed co-operative franchise and has all its difficulties and dangers from ignorance of the operators. Fortunately the bill is not liable to pass both houses of the legislature or the Governor.

Professor M. H. Robinson, in a paper before the Illinois Sanitary and Water Supply Association, suggests some terms for a state public service commission law which would insert the profit-sharing co-operation of city and company under state regulation.

STANDARD PAVING SPECIFICATIONS.

Some criticisms of the specifications adopted by the organization for standardizing paving specifications assert that they are of variable quality and there have been numerous expressions of opinion about them.

So far as MUNICIPAL ENGINEERING is informed there have been but few adverse criticisms of the asphalt specifications. This should be the case, because they were prepared by a well-informed committee, with an unbiased expert in its membership, after full consultation with all the commercial asphalt chemists who could be reached.

The criticism of the brick specification is regarding its incompleteness. The method of laying a brick pavement is given in full detail, and as the specification prepared by the National Paving Brick Manufacturers' Association was adopted, experience has demonstrated that the best results attainable will be secured. The committee making the report did well to cut the specification for the brick to a minimum and call it temporary, for the N. P. B. M. A. is now engaged in making experiments which will give fuller knowledge of how to determine the qualities of bricks, and thus make it possible to devise a more accurate and more definite specification than has heretofore been possible.

There has been the most criticism of the wooden block specification, particularly of the specification for the preservative oil, and one chemist has gone so far as to say that the specification is an entire departure from former practice, and that former results may be no criterion by which to judge the future sufficiency of the preservative method. The collection of some of the specifications in use, which will be found in this month's "Question Department" indicates, however, that this departure is not so sudden nor so complete. Indeed, the specifications divide themselves into two classes, one including those in use for timber preservation generally, which is quite different from the newly adopted specification, and the other those in use by cities for treating paving blocks, which has many points in common with the new specification and from which it is not so radical a departure. It will be noted that several chemists consider high specific gravity of creosote oil suspicious and this is one of the principal points of criticism of the new specifications, but it will be noted also that this is not peculiar to the new specifications, but has been in use for several years. The city of Indianapolis in its new specifications has not followed the new specification for creosote oils, and the result is shown in the comparative collection of specifications referred to. The reasons for the differences in the two classes of specifications are also shown in the same article.

The specifications for the new pavements, concrete, bituminous macadam, oil and tar treated roads, were all presented as tentative, and the organization was continued to consider further the pavements which are now in a stage of further development.

THE QUESTION DEPARTMENT

Specifications for Concrete Dam.

Will you kindly advise me where I can get a good set of specifications for a concrete dam?

R. A. W., Batavia, N. Y.

Subjoined are the specifications for the East Park dam on Little Stony Creek, in the Orland project of the U. S. Reclamation Service, near Stonyford, Colusa Co., Cal. Our readers are invited to send other specifications for this and other kinds of concrete dam work.

The general conditions are omitted and the specifications begin with those for the dam proper.

38. The Requirement.—It is required that there be constructed and completed in accordance with these specifications and the drawings hereinbelow listed a concrete masonry dam of the gravity type with appurtenant structures.

39. List of Drawings.—General maps, plan, section and elevations of dam, section and details of dam, details of outlet works, plan and details of spillway, typical section and plans of dikes.

40. General Information.—The elevation of low water at the dam site is assumed at 100 and is indicated by a bench mark that may be seen at the dam site. The location of borings made to determine the depth to bedrock and the character of the materials encountered as indicated by the borings are shown on drawing. Dotted contour lines showing the surface of rock below the stream bed are assumed from the indications of the borings. Cores from bore holes will be shown, on application, to the bidder, who must make his own deductions regarding the depth to rock and character of the materials between bore holes.

41. Beginning and Completion of work.

42. Failure to Complete Work in Time Agreed Upon.—(Deductions, $25 a day.)

43. Progress Estimates and Payments.

44. Cement.—All cement will be furnished by the United States on board cars at the railroad station that, in the opinion of the engineer, is most convenient to the work. The contractor shall haul the cement from the railroad station to the work and shall be responsible for all demurrage charges. He shall furnish suitable warehouses for storing the cement until used, and will be held responsible for any loss or injury to cement after its delivery at the railroad station. If the cement is shipped in sacks the contractor will be held responsible for the return of the full number of sacks to the railroad station in as good condition as when received and will be charged for all lost or damaged sacks at the same rate as paid by the United States. The contractor shall give the engineer sixty days' notice in writing as to when he will require cement and shall state definitely the amount in carload lots and approximately in barrels, that he will require. The cost of hauling and caring for cement shall be included in the unit prices bid for concrete.

CONCRETE.

46. Measurement and Payment.—The concrete required in connection with the work covered by these specifications will be measured to the neat lines shown on the plans or to those ordered by the engineer. The unit prices bid shall include the cost of furnishing all forms and all material except cement and permanent metal work and shall cover the handling and storing of cement and the furnishing of all labor.

47. Composition.—The concrete shall be composed of Portland cement, sand, gravel and water in proportions to be fixed by the engineer. The proportions shall be determined by measurement before mixing and will generally range between one part cement to seven parts of admixture and one part of cement to ten parts of admixture, the term admixture being understood to mean the sum of the volumes of the sand and gravel measured before mixing. Whenever the thickness of the concrete exceeds two feet, large sandstone blocks shall be embedded therein.

48. Sand and Gravel.—Sand and gravel for concrete will be obtained from natural deposits in the vicinity of the dam, carefully selected to comply with the specified requirements, and the material after being excavated shall be screened so as to produce three graded sizes, as follows: Material passing a two and one-half inch round hole and rejected by a one-inch round hole; material passing a one-inch hole and rejected by a one-quarter inch round hole; material passing a one-quarter inch round hole. All material rejected by a two and one-half inch hole shall be wasted. All this material shall be free from organic matter and each engineer will from time to time determine the proportion of each of the various sizes to be mixed into concrete, the object being to secure the densest possible mixture. In case there is a shortage in any one size, the same shall be promptly supplied by the contractor, and he shall not be entitled to payment for surplus of any graded size of the material.

49. Water.—Water for mixing concrete shall be free from organic matter, oil, grease or other like impurites and shall be otherwise reasonably clean. The amount of water to be added to the mixture will be determined from time to time by the engineer.

50. Mixing.—The mixing of concrete shall be performed by machinery in good order. The material shall remain in the mixer a sufficient length of time to produce thorough mixing. All mixing shall be done to the satisfaction of the engineer.

51. Sandstone Blocks.—There shall be embedded in all concrete having a thickness in excess of two feet as large a proportion of sandstone blocks between twenty and thirty-five per cent of the mass of concrete as is practicable in the

judgment of the engineer. The sandstone blocks shall be free from cracks and flaws, close-grained, hard and of a quality that does not weather. They shall be clean and thoroughly wet before being placed in the work and shall be roughly cubical in shape and form one cubic foot to one cubic yard in volume. The contractor shall provide a plant capable of handling with ease rocks up to one cubic yard in size.

52. Placing.—All rocks surfaces upon which concrete is to be laid shall be clean and thoroughly wet immediately before the concrete is to be deposited. Under no conditions shall concrete be laid in deep, moving or muddy water. The dropping of concrete from such heights or moving it over such distances as will cause separation of its constituents will be permitted only with special consent of the engineer, and in such cases the concrete must be thoroughly remixed before being placed. Concrete shall be used "wet" whenever practicable, and "dry" only when rendered necessary by circumstances. If laid "dry" the concrete shall be well tamped with heavy tamping bars until water flushes to the surface, and if laid "wet" it shall be worked with suitable spades, bars and forks so that porosity and rough surfaces shall be avoided. In concrete exceeding two feet in thickness, the contractor shall embed sandstone blocks as specified in Paragraph 51 and in accordance with the instructions of the engineer. The concrete shall be built as directed by the engineer in layers of from six to nine inches in depth, into which the blocks shall be sunk so as to receive solid bearings and avoid all cavities. The blocks shall be so placed in the work as to leave at least six inches of concrete between the smaller and twelve inches between the larger blocks. When a six-inch layer of the working surface of the dam cannot be completed during any one day, the unfinished end of such layer shall be formed in broken lines in strict accordance with the instructions of the engineer. Concrete laying will not be permitted when the atmospheric temperature drops below thirty degrees. No concrete shall be laid except in the presence of an inspector.

53. Joining Work.—In joining new work with old, the latter shall be thoroughly cleaned of dirt and loose material of every kind and thoroughly wet, and, if required, it shall be roughened before the new concrete is deposited. Where expansions joints occur the faces of the old concrete, after being cleaned dry, shall be given a heavy coat of crude oil satisfactory to the engineer, which shall have at least one day's drying before fresh concrete is laid against it. Compensation for this work, including the furnishing of oil, shall be included in the unit prices bid for concrete.

54. Initial Set.—All concrete that has acquired an initial set before being deposited will be rejected or shall be remixed, at the option of the engineer. If rejected, it shall be promptly removed from the work. The cost of the cement to the United States will in such cases be charged to the contractor and deducted from any amount otherwise due him.

55. Forms.—In constructing forms the ribs shall be of sufficient size and so spaced as to prevent springing. The lagging shall be not less than 1½ inches in thickness and shall be surfaced on one edge, and where concrete surfaces are to be exposed it shall be surfaced on one side. It shall be of uniform thickness and of selected material. The forms shall be skillfully framed and fastened to secure even surfaces and true shapes for the concrete. All forms shall be removed before completion of the work.

56. Finishing Concrete Surfaces.—Immediately after the removal of the forms rough surfaces and irregularities of exposed work shall be dressed down and all voids shall be neatly pointed with mortar. The top surfaces of concrete, where exposed, shall be floated to a true and smooth surface before the concrete has attained its initial set.

57. Sprinkling.—All concrete shall be kept wet for at least ten days after placing.

58. Setting Iron and Steel.—All steel reinforcement, gates, anchor bars, pipes and other metal fixtures shown on the drawingsc or otherwise required, shall be carefully set in the exact position shown in drawings or indicated by the engineer, for as specified in Paragraph 45.

59. Description.—Under the heading Main Dam is included all work necessary for the construction of the concrete masonry dam with outlet works on Little Stony Creek. Gravel and sand for the concrete may be obtained from gravel bars immediately below the dam, so far as suitable material can be obtained from this source; also from gravel bars about one mile upstream from the dam. Sandstone rock may be obtained from a quarry about one mile from the dam.

60. Measurement and Classification of Excavation.—All material required to be excavated in exposing and preparing the foundation for the dam and outlet works will be measured in excavation and classified for payment as follows:

Class 1. All material overlying bedrock.

Class 2. All bedrock below elevation 100.

Class 3. All bedrock above elevation 100.

61. Control and Diversion of Stream.—Little Stony Creek drains an area of 102 square miles. The surface flow during the time that measurements have been made is shown in the following table (omitted).

There is to be provided an opening 24 inches in diameter through the dam at creek-bed elevation as shown in drawings. Until the dam is raised to the elevation of the main outlet, all water that cannot pass through this 24-inch opening must be stored or allowed to flow over the dam. After the dam is raised above the elevation of the main outlet, the latter will also become available for passing water, limited, however, to the passage of 200 second-feet and subject to the approval of the engineer. The contractor shall repair without cost to the United States, except for required cement, all damage done to the work prior to its final completion. Payment for the work of diversion, control and pumping shall be included in the unit prices bid for the various items in the schedule.

62. Excavation for Foundation.—All material in the creek bed overlying the foundation of the dam shall be excavated to bedrock. The excavated material shall be deposited on the downstream side of the excavation and in such manner as not to interfere with the construction and subsequent operation of the works. It shall be at the option of the contractor to utilize as much of this material in construction as shall be deemed suitable by the engineer. Payment for this work will be made at the unit price bid for Item 1, and the quantity upon which payment will be based shall be the mass lying vertically above the neat lines of the

base of the dam. All seamy and rotten rock shall be excavated and removed. A trench along the water toe of the dam and necessary steps for proper footings for the masonry, as required by the engineer, shall be excavated. Excavation shall be done by means of picks, gads, bars and other suitable tools, the use of explosives being prohibited. The work of excavating shall be so conducted as to prevent excavated material from coming in contact with freshly deposited concrete. The excavated material shall be so deposited on the downstream side of the dam as not to interfere with the work of construction and the subsequent operation of the completed structure. The surface of the foundation shall be thoroughly cleaned with brooms and water jets to the satisfaction of the engineer. Payment for the excavation and deposition of such rock will be made at the unit prices bid for Items 2 and 3.

63. Commencement of Masonry Work.—All seams in the foundation shall be thoroughly cleaned and grouted, and any springs of ground water that appear shall be controlled in a manner approved by the engineer. The excavation shall be kept free from water, and dry cement shall be scattered over the surface of the rock prior to depositing concrete. Payment for this work shall be included in the unit prices bid for Item 4.

64. Foundation Pit.—The elevation of the water in the foundation pit must be kept at all times under control, so that no water will be in contact with the concrete until it is at least forty-eight hours old and no pressure must be allowed against it until it is at least seven days old.

65. Progress of Work.—The dam shall be carried up as nearly level as practicable over its entire length and as a monolithic structure up to elevation 155. In case of any difference in elevation during construction, the work on the downstream face of the dam shall never be lower than that toward the upstream face. Above elevation 155 the work shall progress in alternate sections separated by expansion joints, which joints shall lie in vertical radial planes 20 feet apart, measured along the center line of the dam at the top, and which shall continue upward to the main top of the dam at elevation 187. The alternate sections shall make thorough junction with the dam below and may be built up to any height in advance of intermediate sections.

66. Masonry Above Elevation 187.—The parapet wall shall be built in alternate sections ten feet in length, the ends of which shall be coated with crude oil, after which the intervening sections shall be built in. Crude oil shall also be employed on the sides of the railing posts and at other points where shown on drawing, or as required by the engineer.

67. Resumption of Work After Flood Season.—In case the surface of the concrete upon resumption of work during the year 1910 shall ,in the engineer's opinion, be too smooth to secure proper bond with the new work, the surface of the work shall be roughened and dry cement shall be scattered over the old surface before new concrete is deposited, as may be required by the engineer.

68. Twenty-four Inch Outlet.—A 24-inch outlet shall be constructed near creek-bed elevation, and a standard gate and cast-iron pipes shall be placed in positon therein, and from the end of said pipe an opening shall be provided through the dam as shown in drawings, or as directed by the engineer. The cast-iron pipe, gate and appurtenances will be furnished by the United States, and the handling and placing thereof will be paid for as provided in Paragraph 45.

70. Main Outlet Works.—The main outlet works shall be built as shown on drawings. All concrete in the gate tower and in the walls of the conduit below the dam will be paid for at the unit price bid for concrete.

71. Gates.—All gates and appurtenances shall be set as shown on drawings, or as directed by the engineer. The entire operating gear shall be left in perfect and easy working condition. The handling and setting of the gates and appurtenances will be paid for as provided in Paragraph 45.

72. Anchor Bolts.—All anchor bolts shall be set as shown in drawing, or as directed by the engineer. They will be furnished by the United States and the handling and setting thereof will be paid for as provided in Paragraph 45.

SPILLWAY AND DIKES.

75. Preparation of Spillway Foundation.—At all points where concrete is to be deposited all earth overlying bedrock shall be removed. The material shall be wasted in the vicinity of the excavation and in accordance with instructions given by the engineer. Trenches and all seamy and rotten rock shall be excavated and the excavated material shall be deposited in accordance with instructions given by the engineer. The surface of the rock shall be thoroughly cleaned and wet to the satisfaction of the engineer before any concrete is deposited.

76. Spillway Masonry.—The masonry in the spillway shall consist of concrete with embedded sandstone blocks, as specified in paragraphs 47 to 58, and will be paid for at the unit price bid for Item 7. No concrete shall be deposited in the spillway during the period from April to September, inclusive.

77. Trenches for Dikes.

78. Dike embankments.

79. Pitching.

Cost of Street Cleaning.

The city of Eureka put in about 15,000 square yards of brick paving a year ago and is now confronted with the problem of keeping it clean. Please advise us whether for this amount it would be worth while to purchase a sweeping machine, or would it be more economical to do the work by hand? About what will the relative costs of hand and machine sweeping be?

RICHARD DICKINSON,
Mayor, Eureka, Ill.

It would doubtless be less expensive to clean this area of street by hand, unless a team used for some other purpose can be utilized for the short time necessary to sweep the street, or it is thought advisable to sweep the street every day. In that case the same man and team could be utilized for picking up the sweepings from the gutters and the man could put in any idle time in picking up horse droppings where teams are most numerous. The mile or less of street would thus be kept perfectly clean at the cost for apparatus of a sweeper, a wagon for removing sweepings and the necessary hand scraper and shovel for the gutter work and picking up droppings, and a cost for operation of one man and team. If the city owns the whole outfit the cost would be, say, $3 a day, including an allowance for new

brooms, repairs, etc. Or the estimate can be made on the cost of hiring a man with his team by the day and buying or filling two or three brooms during the season, and new scrapers and shovels each year. Names of makers of sweepers, scrapers, dump wagons, etc., will be found in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings, "Dump Boxes," "Dump Carts," "Dump Wagons," "Street Cleaners' Carts," "Street Scrapers," "Sweepers," "Wheel Barrows."

It would require two men, each with hand scraper and broom and two-wheeled cart, to keep 15,000 square yards of pavement clean, and it would keep them busy unless the sweepings were carried away by someone else. The cost in this case for apparatus would be the two street cleaners' carts, the scrapers and brooms, and the cost for operation would be the wages of the two men, four to six hand street brooms a season and, say, two scrapers.

The maintenance and repair bills should be very small, so that the reative cost can be determined from the comparison of cost of man and team and of two men. The outfit for hand cleaning would not cost as much as that for machine cleaning.

In the March number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 193, will be found some figures of cost of street cleaning.

Compensation for Street Railway Franchises.

We will shortly submit to the voters of this city a proposition to amend the street railway franchises, providing for the street railways to pay into the city treasury a certain percentage of their gross earnings for the privileges they enjoy from the use and occupancy of the streets.

As the corporations and their friends will naturally unite to fight us, I would appreciate any statistics or information that you may be able to send me that will assist in presenting arguments on the subject to the voters. I would like statistics and information concerning the cities that are now operating under such public utility regulations, showing the gross earnings of the corporations and the amount and percentage of revenue derived therefrom by the cities.

PERCIVAL E. WOODS,
Supt. Dept. Finance, Ways and Means,
San Diego, Cal.

The publications of the U. S. Census Department give the fullest information on this subject. The special report on "Street and Electric Railways, 1902," gives some information as to methods of regulating fares and compensation for franchises. Statement of the requirements in each city, taken from this report, will be found in MUNICIPAL ENGINEERING, vol. xxx, p. 276. In some cities the rates for fare are reduced as the profits of the business increase, in others payments to the city treasury are required which may be constant or may be increased by definite amounts at definite times, or may be a definite percentage of the gross receipts, which again may increase or decrease as time passes or as the total amount of gross receipts increases. There are also the regular taxes, which may be imposed without reference to compensation for franchise or reduction in fares, or may be included therein. The compensation may also take the form of car licenses. Thus all the common methods of raising revenue employed by a municipality are applied to street railway companies either singly or in any combination, and also the reduction in fares.

Car licenses are collected in many cities, particularly in the South. A few cities charge licenses by the length of car. Some charge for all cars owned and others on the average daily number in use. Some Pennsylvania cities charge per pole instead of per car, thus reducing the tendency of the operating company to keep down the number of cars.

Nearly all cities require the companies to pave between rails and tracks and for three-fourths to two feet outside. The companies are sometimes required to keep their tracks clean and even sprinkled or the city does the work and assesses against the company its share of the cost of the whole street. A few of the smaller towns require the company to furnish free street lights, especially at the streets crossing the street railroad lines.

The commonest form of compensation for franchise is a percentage of gross receipts. Most municipalities using this plan net less than 3 per cent. after the ordinary taxes are allowed for.

The U. S. Census Bureau's "Statistics of Cities Having a Population of over 30,000 for 1906" and for 1907 give the receipts from taxes, licenses and direct payments for public service privileges for many cities. An article on another page of this number of MUNICIPAL ENGINEERING, "Percentages of Receipts as Compensation for Street Railway Franchises," gives a collection of information on the particular question asked.

Cost Keeping for Engineers.

We should be very glad to have you advise us where we may secure a good book on a system of "cost keeping" for an engineering firm. We know of a number of good works of this kind on cost keeping for contractors and general work, but have been unable to find anything that meets the requirements for a firm doing a general engineering business. Thanking you for any favors in this regard, we are P. G. C., ——, S. D.

Can our readers refer us to such a book or article? A good book on the principles of cost keeping, such as Millener's "Cost Accounting" or possibly Gillette and Dana's "Cost Keeping and Management Engineering," or an article such as Moore's "Cost Keeping on Municipal Contract Work" in MUNICIPAL ENGINEERING, vol. xxxvi, p. 1, gives the principles upon which to base an accounting system. The details must be worked out for the particular business.

The first thing to determine is the amount of detail desired. This must be limited by the ability of subordinates to distribute their time and supplies used over the various items and by the cost of keeping the records. It is not difficult to devise a system of cost keeping which will be more expensive than is necessary, or that will have a cost out of all proportion to its usefulness. It is easiest to begin a system on broad lines with few items and then to differentiate these items as experience shows the desirability of such a course.

One with a strong tendency toward system can often work out a more satisfactory system in his own office than can be worked out by an expert in office systems who tries to make a machine which will from the beginning show all possible details and thus overloads his system and thereby throws it into disrepute.

Suggestions as such systems as may have been worked out by our readers are solicited for publication as aids to other engineers.

Specifications for Creosote Oil.

I am enclosing a portion of my wood block specifications pertaining to the oil with which the blocks are treated and will appreciate it very much if you will give me your opinion on the following points:

1. Will a minute trace of free carbon affect the quality of the oil, and will it interfere with the block being thoroughly permeated with the oil?

2. When the oil is dissolved in bensol will a small quantity of suspended matter affect the thorough penetration of the wood?

3. Would you advise a change in the specifications to allow a small quantity of free carbon and suspended matter when dissolved in bensol, or let the specifications remain as they are?

4. Is it possible to produce a heavy oil without a trace of carbon?

S., Chief Engineer.

It seems to me that the specifications for oil with which to treat creosoted wood paving blocks adopted at the Chicago convention of city paving officials make a wide departure from the former practice, and I would like to know how they really differ from previous standard specifications. SUBSCRIBER, ————, Ind.

Specifications for creosote oil have been changed frequently since the treated wood block paving industry began in this country some twelve or fifteen years ago.

Previous to that time the use of creosote was mainly as a preservative and oils were selected with this quality in view, permanence requiring also oils which would be as slightly volatile as possible and sometimes as nearly insoluble in water as possible. It was seldom required that the timber be filled full of the preservative and therefore the specifications regarding free carbon and other insoluble matter were rather to determine the quality of the oil than to take account of the treatment of the blocks with the oil.

But when the wooden block paving began it was soon found that the oil must not only be preservative of the wood, but it must be non-volatile and insoluble in water, and must fill the pores of the block completely in order to produce the full effect required for a perfect pavement. Free carbon cannot enter the pores of the wood except very imperfectly, and by stopping the pores may prevent the entrance of the oil. The same is true of any other insoluble matter and even of crude tar. Attempts have been made to prevent the solution of oil in water and its volatilization by closing the pores at least near the surface with some insoluble, non-volatile substance so that water and air cannot reach the oil within, even if it does not completely fill the pores within the block. These substances are difficult to force into the block and the proportion used has declined as experience has shown that a less quantity produces a better result. The latest specifications practically ignore these admixtures and depend mainly upon the oil to be injected. It is evidently more necessary to keep the proportion of free carbon, insoluble substances and tarry substances down in oils intended for treating paving blocks than in purely preservative treatments.

The above questions may perhaps be best answered, though not with perfect definition, by showing what the tendency has been in the changes of specifications which have taken place, and the following have been taken as probably typical cases, though they do not give all the variations nor all the steps in the variations in particular cases.

Circular 112 of the Forest Service, U. S. Department of Agriculture, gives standard methods of analysis and grading of creosotes for preservative purposes. The Bureau of Forestry in 1903 urged the general adoption of the following as indicating a high-grade oil by the best European standards:

1. The tar oil must be clear, i. e., there must be no substances in suspension as tested by a drop of oil on filter paper.

2. The specific gravity must be about 1.04 to 1.10 at 20 degrees C. The boiling points must be as follows: Up to 150 deg. C. nothing must come off; up to 200 C. not more than 10 per cent; up to 235 C. not more than 25 per cent., and up to 355 C. at least 90 per cent. must come off.

3. The oil must be soluble in benzine or absolute alcohol.

Specific gravity of oils solid at 20 deg. C. should be taken at 2 degrees above their melting point and reduced to 20 deg. The presence of 0.5 per cent. of insoluble matter, which is probably free carbon, should not cause rejection of the oil.

More detailed specifications for various grades of oil are derived from the tables, diagrams and text in Circular No. 112.

An excellent paper by Capt. John C. Oakes, printed by the U. S. Engineer Bureau, discusses the whole question, quoting the above named circular and others, and gives the following specification:

Oil should be of the best English coal-tar creosote oil or its equal without admixture of other oils or substances not derived from the distillation of coal tar. The relative gravity at 60 deg. C. com-

pared to water at the same temperature should be not less than 1.04. It should contain not more than 3 per cent. water, the percentage to be compensated for in computing amount of oil to be injected; not more than 5 per cent. should distill below 210 deg. and not more than 25 per cent. below 235 deg. C., using methods of Circular 112. Not more than 5 per cent. tar acids should be allowed in oil.

Capt. Oakes recommends 60 deg. C. as temperature of specific gravity determination, but allows determinations at other temperatures, with change of 0.0008 per degree C., or 0.00044 per degree F., to reduce to the standard. An oil with specific gravity above 1.07 is considered suspicious, for unless it is almost wholly lacking in the low-boiling fractions it may have hard pitch or undistilled coal tar mixed with it.

The methods of analyzing creosote adopted by the American Railway Engineering and Maintenance of Way Assiciation given in Bulletin No. 65 of the association (50 cents) have been made the standards for paving blocks also by the organization for standardizing paving specifications. This bulletin does not give specifications, simply methods of analysis and forms for specifications.

The Atchison, Topeka & Santa Fe R. R. uses the above form of specifications, fixes a range of specific gravity between 1.00 and 1.10 at 60 deg. F., requires the oil to be perfectly liquid at 100 deg. F. and to remain so on cooling down to 90 deg. F.; changes the boiling test to not more than 30 per cent. distilling over between 210 and 235 deg. C. and at least 90 per cent. below 355 C.

The Prussian state railway administration requires for treating railway ties a tar oil containing not more than 1 per cent. that boils below 125 deg. C. The boiling point of the whole must be between 150 and 400 C. and not more than 25 per cent. must become volatile below 235 C. At least 20 to 25 per cent. must be acids dissolving in caustic soda lye of 1.15 specific gravity. At 15 deg. C. the tar oil must be completely fluid and as free as possible from napthaline, so that when distilled in glass vessels in groups of 50 deg. each it shall give off not more than 5 per cent. of naphthaline. The specific gravity at 15 deg. C. must lie between 1.020 and 1.055.

It should be remembered that the above specifications pay no attention to the use to which the timber is put, while those which follow are prepared for application to paving blocks.

In 1909 J. N. Hazlehurst, C. E., presented a paper, which will be found in MUNICIPAL ENGINEERING, vol. xxxvii, p. 379, in which he states that he started with a specification of "a heavy creosote product with specific gravity not less than 1.12 at 68 deg. F., not more than 40 per cent. to distill below 600 deg. F., and the specific gravity of the residue to be not less than 1.15, the oil to be devoid of carbon and absolutely soluble in bensol. On account of objections by bidders he investigated the subject through chemists and engineers and seems to have concluded that oil of this description is monopolized, and quotes chemists to the effect that by the very nature of creosote oil the specifications cannot be filled to the letter, as the temperature of distillation will split some of the higher hydrocarbons, making more or less carbon deposit and more or less insolubility in bensol, or the oil will be mixed with tar, as much as 10 per cent. being frequently used, and the tar and some of the oil will not be dissolved in bensol. As a consequence Mr. Hazlehurst offers the following:

The oil shall be a pure coal tar product completely liquid at 68 deg. F., and showing no deposit at this temperature. Its specific gravity shall be at least 1.12 and the oil at 68 F. shall not contain an excess of 2 1-2 per cent. of matter insoluble in bensol. With the thermometer suspended above the oil not more than 40 per cent. shall distill below 600 deg. F.

The Wyckoff Pipe and Creosoting Company in 1908 published a specification which they considered to represent the best practice in this country and in Europe. It requires the creosote to be a dead oil of coal tar containing not more than 3 per cent. of water and only traces of acetic acid and acetates. Its specific gravity at 100 deg. F. (38 C.) to be between 1.03 and 1.10. To leave only a trace of residue on the filter paper when filtered between 60 and 77 deg. F. To contain about 25 per cent. of crystallizable naphthalene and at least 15 per cent. anthracene oils and at least 95 per cent. to be soluble in carbon bisulphide and in absolute alcohol.

The specification for treating blocks with creosote and resin used in 1900 provided for a mixture of 38 per cent. of dead oil of coal tar, 2 per cent. of formaldehyde, 60 per cent. of melted rosin, the specific gravity of the resulting mixture at 300 deg. F. being 1.068, when it is perfectly fluid. In 1904 this had changed to 50 per cent. each of creosote and resin, and in 1906 to 75 per cent. creosote and 25 per cent. resin, according to New York practice.

S. Whinery in his "Specifications for Street Roadway Pavements" (50 cents), published in 1907, gives the following specification:

The oil used for preservative treatment, commercially known as creosote oil, shall be dead oil of coal tar without adulteration. Oil known to the trade as "wood creosote oil" will not be accepted. The dead oil of coal tar shall not contain more than 1.5 per cent. of water, nor more than 5 per cent. of tarry matter. Its specific gravity at 60 deg. F. shall not be below 1.02 nor above 1.07. Subjected to distillation, no part of it shall be volatile at a temperature of 300 deg. F., and it shall not lose by evaporation more than 20 per cent. in weight when maintained at a temperature of 400 deg. F. for 4 hours. With increased temperature it shall yield not

less than 45 per cent. nor more than 55 per cent. of naphthaline. The residue, after exposure in a shallow dish to a temperature of 650 deg. F. for 3 hours, shall not exceed 10 per cent. of the original weight. The oil, freed from water, shall be wholly soluble in carbon disulphide. Special preservative processes involving the use of resin, pitch or other substances admixed with creosote oil may be used, provided that the treated wood shall contain not less than 10 pounds of creosote oil per cubic foot of wood and provided further that the substances thus mixed with the creosote oil shall not, in the judgment of the engineer, be in themselves deleterious and shall not in any way neutralize the value and preservative properties of creosote oil.

Following are some city specifications, showing the variations in different cities and the variations in the same city at different times:

The Chicago specification prior to the convention above referred to required the creosote oil to be a pure coal tar product, free from any adulteration or containing no petroleum nor more than 5 per cent. of matter insoluble in benzine. Oil obtained or partly obtained from water gas tar or oil tar would not be accepted. The specific gravity to be at least 1.1 at 25 deg. C. Evaporation to be zero up to 150 deg. C., not more than 5 per cent. to 210 deg., not more than 15 per cent. to 235 deg., not more than 40 per cent. to 315 deg. C.

The Cincinnati specifications in 1909 provided the following:

The oil shall be a "heavy or dead oil of coal tar," which must be free from adulterations, and must be obtained wholly and entirely from coal tar, and must not contain any oil derived from water gas tar, oil gas tar or other tars. The specific gravity at 60 deg. F. (20 C.) shall not be less than 1.10. The oil shall be free from carbon and shall contain not more than 2.5 per cent. of matter in suspension. When distilled in a retort with the thermometer suspended not less than 1 inch above the oil it shall lose not more than 35 per cent. up to 315 deg. C.

Indianapolis specifications have been changed from time to time as the industry has developed. It will be remembered that this city began the use of modern wood block pavements first of any American city and the early specifications required no treatment or simple dipping. The 1904 specification was as follows:

The oil which has heretofore been designated as heavy creosote oil shall be understood to be an oil obtained from the distillation of coal tar. This heavy creosote oil shall be kreodone oil of a standard as shown by test heretofore made in the office of the city civil engineer and on file in said office, or a heavy creosote oil. Both said oils, whether kreodone oil other creosote oil, must comply with the following conditions:

1. It shall be completely liquid at a temperature of 70 deg. F. or 21 C. and exhibit no signs of any deposit or cooling down to a temperature of 65 F. or 18 C.

2. It shall yield a total of at least 6 per cent. of tar acids when tested in accordance with the instructions annexed.

3 It shall contain at least 50 per cent. of constituents that do not distill at 600 F. (316 C.) nor more than 60 per cent.; nor shall more than 10 per cent. distill below 400 F. when tested in accordance with instructions annexed. It shall have a specific gravity of 1.040 to 1.075, water being 1.

5. The creosote oil shall contain not less than 15 per cent. of naphthalene nor more than 25 per cent. when tested in accordance with the instructions annexed.

6. The residue from distillation of 100 c. c. of the oil shall not have more than 10 per cent. of carbonaceous or bituminous matter when tested in accordance with the instructions annexed, and upon cooling shall show authracene crystals.

The specifications of 1906 require that the "paving oil" shall be "a heavy creosote product," with specific gravity of 1.12 at 68 deg. F.; reduce the distillation product to not more than 35 per cent. passing over at 600 deg. F., with no other requirement except that the specific gravity of the residue at 600 F. shall not be less than 1.15; and add the provision that the oil must be free from free carbon, absolutely soluble in benzol so that it will readily penetrate the wood.

The specifications for 1910 do not follow those adopted at the Chicago convention for standardizing specifications. They are as follows:

The creosote shall be derived from the distillation of pure coal tar and shall be free from any adulteration whatever or any admixture of undistilled tar. It shall be free from insoluble or suspended matter, and shall contain not more than 3 per cent. of water by weight, and shall have a specific gravity at 60 deg. C. of not less than 1.04. The creosote shall have the following fractions: Up to 205 deg. C. not more than 5 per cent. Up to 225 deg. C. not more than 40 per cent. nor less than 5 per cent. Up to 250 deg. C. not more than 50 per cent., nor less than 15 per cent. Up to 295 deg. C. not more than 65 per cent., nor less than 30 per cent. At 355 deg. C. the residue must be soft.

The Mobile, Ala., specification for 1909 is the same as the Indianapolis specification of 1906 above. That for 1910 has been changed.

In Brooklyn prior to 1906 the specifications provided for a mixture of 50 per cent. creosote and 50 percent. resin, requiring treated blocks to be of certain quality rather than the materials with which they were treated. In 1906 the specifications were changed requiring an antiseptic and waterproof mixture of 75 per cent. creosote or heavy oil of coal tar and 25 per cent. resin. The creosote oil was required to have a specific gravity not less than 1.12 at 68 deg. F. (20 C.), to lose not more than 35 per cent. up to 315 deg. C. and not more than 50 per cent. up to 370 deg.; to be free from adulteration, not mixed with or contain any foreign material. Oil completely extracted from fine turnings from a treated block with ether or carbon bisulphide was required to be distilled, the part coming off below 120 deg. C. to be collected separately and the oil obtained by distilling

up to 370 deg. to fill the above specification.

Boston required creosote oil to have a specific gravity of 1.12, and Minneapolis of 1.09.

A Manhattan specification of 1909 requires the specific gravity to be 1.12 at 38 deg. C. and the distillate between 255 and 315 deg. C. to have a specific gravity of 1.02 at 60 deg. C., the oil to lose not more than 35 per cent. up to 315 deg.

The full specifications adopted by the Organization for Standardizing Paving Specifications in February, 1910, will be found in MUNICIPAL ENGINEERING, vol. xxxviii, p. 247. In brief they require specific gravity at least 1.10 at 38 deg. C.; not more than 3 per cent. insoluble with bensol and chloroform, not to exceed 2 per cent. distillate up to 150 deg. C. and 35 per cent. up to 315 C.

It will be noted that all the above specifications except those of cities, when reduced to the temperature of 38 deg. C. to compare with the last one, give a minimum specific gravity of 1.00 to 1.06 and a maximum of 1.05 to 1.10, omitting the Prussian figures. It will also be noted that the city specifications, with one or two exceptions, fix the minimum at 1.085 to 1.12 and, again with but one or two exceptions, fix no maximum. The Manhattan specification also provides that the specific gravity of the distillate between 255 and 315 deg. C. shall be not less than 1.00 (when reduced to 38 deg. C.).

The requirements for specific gravity are given in the following table, one column reducing them to the standard of 38 deg. C. (100 deg. F.):

SPECIFICATIONS FOR SPECIFIC GRAVITY OF CREOSOTE OIL.

Authority	Sp. Gr. and Temp. in Specifications	Sp. Gr. at 38 deg. C.
Forest Service	1.04 to 1.10 at 20 C	1.025 to 1.085
Oakes	1.04 to 1.07 at 60 C	1.06 to 1.09
A. T. & S. F. Ry.	1.04 to 1.10 at 60 F	1.02 to 1.08
Prussian Rys.	1.02 to 1.055 at 15 C	1.00 to 1.035
Hazlehurst	1.12 at 68 F	1.105
Wyckoff	1.03 to 1.10 at 100 F	1.03 to 1.10
Whinery	1.02 to 1.07 at 60 F	1.00 to 1.05
Chicago	1.1 at 25 C	1.09
Cincinnati, 1909	1.1 at 20 C	1.085
Indianapolis, 1904	1.04 to 1.075	
Indianapolis, 1906	1.12 at 68 F	1.105
Indianapolis, 1910	1.04 at 60 C	1.057
Mobile, 1909	1.12 at 68 F	1.105
Brooklyn, 1906	1.12 at 20 C	1.105
Manhattan, 1909	1.12 at 38 C	1.12
Boston	1.12	
Minneapolis	1.09	
Org. for Stand. Pav. Spec.	1.10 at 38 C	1.10

There is great variation in the specifications for proportions of distillate at various temperatures.

Up to 150 deg. C. the Forest Service, Whinery and Chicago permit no distillate and the new specification not to exceed 2 per cent., the others making no requirement, and the Prussian railways 1 per cent. at 125 deg. C.

Up to 210 deg. C. the Forest Service permits 10 per cent. distillate at 200; Indianapolis, 1910, 10 per cent. at 205; 1904, 10 per cent.; Whinery, 20 per cent. at 205; Oakes and Chicago, 5 per cent. at 210.

Up to 235 deg. C. the Forest Service, Oakes and the Prussian railways permit 25 per cent. distillate; Chicago, 15 per cent., and Indianapolis, 1910, 5 to 40 per cent. The A., T. & S. F. Ry. requires 30 per cent. distillate between 210 and 235 deg. C.

Indianapolis in its new specification goes into greater detail, prescribing 15 to 50 per cent. of distillate at 250 deg. C. and 30 to 65 per cent. at 295.

Up to 315 deg. C. and 600 deg. F. Cincinnati, Indianapolis, 1906, Mobile, Brooklyn, Manhattan and the Standardized Paving Specification permit 35 per cent. distillate; Prussian Railways and Chicago, 40 per cent., and Indianapolis, 1904, 50 to 60 per cent.

At 355 deg. C. the Forest Service, A., T. & S. F. Ry. and Whinery (at 343) require at least 90 per cent. of distillate, while Brooklyn required not more than 50 per cent. at 370 deg. C.

These variations indicate the need for a standard specification, for a given oil will not fit them all, and what is of high class according to one specification will be promptly rejected by some other. The only specification which has any general acceptance is that restricting the distillate at 315 deg. or thereabouts to 35 or 40 per cent., eight of the fifteen specifications prescribing one or the other, and a ninth 50 to 60 per cent.

But few of the specifications have a provision about free carbon or suspended matter.

Cincinnati, Indianapolis, 1906, and Mobile have the requirement of no free carbon; Indianapolis, 1910, of no matter insoluble or in suspension; but Cincinnati allows not to exceed 2.5 per cent. of matter in suspension.

The others vary in percentage of insoluble, Whinery allowing 5 per cent. of

tarry matter, but requiring all to be soluble in carbon disulphide; the Forest Service, 0.5 per cent.; Hazlehurst, 2.5; the Organization for Standardizing Paving Specifications, 3; Wyckoff and Chicago, 5, and Indianapolis, 10 per cent. of insoluble matter. The others in this list do not mention suspended matter.

The solvents used are benzine or bensol, carbon disulphide, absolute alcohol and chloroform.

Most of the specifications provide that the oil shall be a coal tar product, the most specific that it shall be obtained from the distillation of coal tar, and some that it shall not be adulterated with any other material, or shall not be mixed with coal tar itself, and the proposed standard specification provides that it shall be a coal tar product, but leaves the matter open to the admixture of coal tar if the other specifications can be met.

Indianapolis has met these difficulties to some extent by reducing the specific gravity somewhat, increasing the definiteness of the distillation specification and definitely providing that there shall be no admixture of coal tar.

The Commission Form of Government and the Indianapolis Charter.

Our students are debating the commission firm of government pro and con. We have been informed that the city government of Indianapolis has some peculiarities worth studying in this connection. I shall be greatly obliged if you will point out to me some of the features which in theory and in experience have proven most noteworthy. F. W. M., ————, Tenn.

Several articles upon the various forms which the Indianapolis charter has taken in the twenty years since it was first passed will be found in MUNICIPAL ENGINEERING. The basis was laid in the first document and the changes have been made in details of application, and not always for the better.

The article on "Charter for Small City," in vol. xxiv, p. 26, outlines the provisions of a bill to extend the Indianapolis form of charter to the smaller cities of the State, thus giving the salient points and brief reference to their success in the larger cities of the State. On page 354 of the same volume is a discussion of "Business and Politics in City Administrations," which considers one of the most prominent features of the Indianapolis form of city government, its similarity to the form of government of a business corporation and its equal dependence upon the interest and competence of its stockholders, the voters. The difficulties in the application of the principle under American conditions are discussed in an editorial in vol. xxv, p. 85.

An editorial in vol. xxxiii, p. 100, states some of the defects in various forms of commission government, and makes a comparison with the Indiana form, especially with reference to the business responsibility of the city's officials and the possibility of keeping them up to it. On p. 244 will be found a reply to some comments on the preceding editorial by the daily press. This idea is more fully developed in an editorial in vol. xxxiv, p. 161.

The principal defect in the Indiana form of city government has been the retention of the party organizations in city elections. This is discussed in an editorial in vol. xxxiv, p. 355.

In an editorial on "Plans for City Government," in vol. xxxv, p. 169, are outlined some of the ideas regarding home rule in cities, but at the same time are presented some of the methods of control by experts in the employ of the State of both municipal and private corporations in their operation of technical matters in which their knowledge is, under present conditions, incomplete, or their intentions may not be strictly honorable.

"State Commissions and Municipal Departments," an article by a former city alderman, in vol. xxxv, p. 365, makes some interesting points.

Some account of legislation affecting municipalities is given in vol. xxxv, p. 377.

The success of "Cedar Rapids Under the Commission Plan" is described by one of the councilmen in vol. xxxvi, p. 17.

"The Municipal Business Manager," described in vol. xxxvi, p. 279, is connected with the new forms of government in an editorial on p. 309, which also notes the improvement in the Indianapolis plan of electing a few councilmen by the city at large instead of a larger number by wards. The editorials on the "Bureau of Municipal Research" and "Non-Partisan Municipal Elections," on pp. 375 and 376, suggest methods of still further improving the Indianapolis plan.

The editorial on "Self-Government of Cities," vol. xxxvii, p. 103, elaborates upon one of the points above mentioned with reference to Colorado cities.

"The Latest Commission Form of City Government" is an editorial in vol. xxxvii, p. 393, the title to which may possibly be considered incorrect, in which the new Boston and Indiana plans are compared as to their most prominent features, and some of the advantages of each over the other are suggested.

Some of the difficulties arising under the commission plan in at least one of its forms are shown in an article on "Memphis Under a City Commission," in vol. xxxviii, p. 27.

"Nominations for Office Under the Commission Plan of Municipal Government," in vol. xxxviii, p. 155, develops the idea that one of the principal reasons for the successes with the commission plan has been the non-partisan character of the elections, or at least of the nominations.

"The Illinois Bill for Commission Government," which is not likely to become a law, is described briefly in vol. xxxviii, p. 180, and the reasons are given for the expressed opinion that the plan will prob-

ably be successful in the smaller cities, but is more doubtful in those that are larger.

Information About Sewage Disposal.

I am making a special study of sewage disposal. I will be pleased if you will send me a list of recent publications on the subject, also the numbers of your publication containing articles on sewage works.
R. R., Montreal, Que.

Good books on the subject by English writers are the second volume of Moore and Silcock's "Sanitary Engineering" ($14 for the two); Dibdin's "Purification of Sewage and Water ($6.50); Rideal's "Sewage" ($3.50); Barwise's "The Purification of Sewage" ($3.50); Dunbar and Calvert's "Principles of Sewage Treatment" ($4.50); Vernon-Harcourt's "Sanitary Engineering" ($4.50). A book on particular lines of American practice is Venable's "Sewage Treatment" ($3).

Following are some recent articles in MUNICIPAL ENGINEERING, and additional articles are listed in some of those named:

In vol. xxxviii, p. 177, "New British Sewage Disposal Works;" p. 192, "Information About American Patents on Sewage Purification Processes," giving a list of previous articles.

In vol. xxxvii, "The Sludge Disposal Problem in Sewage Purification," p. 19; "Status of Sewage Disposal in America," p. 80; "Sewage Disposal Plants and Stream Pollution," p. 119; "Joint Action of Cities in Abating Stream Pollution," p. 189; "Information About the Septic Tank," p. 253, giving references to previous articles and lists of articles; "Disinfection of Sewage and Sewage Effluents," p. 365. These articles can be supplied at 25 cents for each number.

Cost of Engineering for Municipal Improvement Project.

I am desirous of obtaining from you some information as to what would be a reasonable and customary charge, based upon a percentage of the total cost of the work as paid to the contractor, for doing all the engineering in connection with the improvement of a city street, the total cost of the work to be approximately $60,000.

The work in question consists of regrading, paving with either vitrified bricks or creosoted wood blocks, together with some granite block paving, all on a concrete base, on nine (9) different streets.

The grades on all of the streets have to be revised and readjusted, many of the concrete sidewalks have to be rebuilt to conform to the new grades, and 5,000 feet of new concrete curbs have to be constructed.

The work to be done by the engineer, for which I desire to know what would be a proper percentage to charge, includes the preliminary plans and estimates, the preparing of the specifications and contract, the subsequent detailed plans and all the necessary engineering superintendence during the execution of the work by the contractor. P., ——, Pa.

One formulated schedule would charge 5.1 per cent. for work costing from $50,000 to $100,000. This is divided into a half dozen items, which may be grouped into two for the purposes of this inquiry, completion of plans and specifications, 2.3 per cent and engineering superintendence and inspection of construction 2.8 per cent. The first figure may be divided into three parts, preliminaries, plans and specification, and details, and say one-half applied to the second and one-fourth to each of the others, but these proportions should be varied to suit the local circumstances. The figure for supervision of construction may also be divided into charges for the engineer and for the inspectors, say two-thirds to the former and one-third to the later, but as actually worked out in the field this division would depend upon the manner in which the work was done. If carried on at one point only and supervised by the engineer himself, there would be no inspection cost, but if carried on at many different places at the same time, with the engineer as supervisor of all the inspectors as well as the progress of the work, the proportion for inspectors might easily over-run the one-third allotted. The work would be completed in less time and the engineer's resulting per diem might be much greater than if he were the only inspector on a slowly moving job.

One important point is the possibility of delay in the work so that it will unduly interfere with the engineer's employment in other directions. Under such circumstances the actual cost of supervision might easily exceed the 2.8 per cent.

This subject is considered in MUNICIPAL ENGINEERING, vol. xi, pp. 47, 104; vol. xiii, pp. 91, 197, (where the schedule of charges referred to is given in full) 226, 302; vol. xv, p. 41; vol. xvi, pp. 1, 97, 193; vol. xxxv, p. 181, regarding fees for street paving engineering; vol. xxxviii, p. 268.

Will our readers suggest something out of their own experience? It has been difficult for engineers to get together on this matter of charges for their services, and discussion of the subject in a reasonable way will help toward the formulation of standards or the acceptance of those already formulated.

Information About Municipal and Private Ownership of Town, Water and Light Plants.

Our town council is considering the proposition of installing a water plant with probably an electric plant in connection. The council desires now to obtain the latest and most correct data and opinions on the question of municipal versus private ownership, and to this end has instructed me to purchase at least one book containing such information. Noting that you have recommended to various inquirers books on their various difficulties, I have decided to ask you to recommend and send a book, which will give a fair statement of the arguments pro and con on the subject of municipal ownership with especial reference to water

plants or light-and-water plants. There will be no objection to conclusions in the book, provided it gives a fair presentation of the two sides. We want a book involving the latest ideas and facts.

TOWN CLERK.

The only books going into detail in the comparison of the results of municipal and private ownership of public service industries are the three large volumes of the report on this subject made by a committee of the National Civic Federation, which can probably be obtained of that organization, 281 Fourth avenue, New York City.

As regards detailed information, the volumes of MUNICIPAL ENGINEERING are probably the fullest unbiased source of information. To begin with the current volume and give a few of the titles of articles in the last two volumes:

In vol. xxxviii: "The Water Works of Marion, Ind," public ownership, p. 4; "Municipal Ownership in Edmonton," p. 30; "Depreciation and Sinking Funds," p. 33; "Relative Cost of Municipal Work Done by Day Labor and by Contract," pp. 76, 194; "Books (and articles) on Electric Light and Gas Plants," p. 107; "Central Stations for Towns of 1,000 Population," p. 169; "Municipal Ownership," p. 175; "Municipal Electric Lighting in Boston," p. 179; "The Illinois Bill for Commission Government," p. 180; several articles on municipal and private water plants giving various detailed information, pp. 185, 186, 187; "Defects in Springfield Water Works," p. 199; "Handling Day Labor in Holyoke," p. 202; "The Combined Electric Light and Water Works of Thomasville, Ga.," p. 249.

In vol. xxxvii: "Cities Owning Water and Light Plants," giving also references to lists of articles on municipal water and light plants, p. 257; "Valuable Data Regarding Water Supplies," pp. 258, 330; "Municipal Gas Plant Experiences," p. 315; "Articles on Municipal Ownership," giving a number of previous articles, p. 324; "Cost of Electric Current," pp. 324, 397; "Water and Lighting Rates in Small Cities," p. 397. These are enough to show that each volume of MUNICIPAL ENGINEERING contains the best of the current discussions on this subject.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Cost of Sewer Construction and Cleaning in Boston.

From Metcalf and Eddy's report to the Boston Finance Commission, the accompanying figures of cost of sewer construction and catch basin cleaning are taken, showing the economy of the contract work under the conditions existing in that city at the time of the investigation.

Comparative Cost of Sewers Built by Day Labor and by Contract in Boston.—The costs of eight pairs of sewers, so selected as to be as nearly comparable with each other as possible, have been compiled in table 1. In each pair one sewer was built by day labor and one by contract. The pairs were selected by engineers employed by the city, who had direct personal knowledge of the conditions under which the work was done. After reducing the costs to equal terms as to size, depth and wages, it appears that in the case most favorable to day labor the cost of the sewer built by direct labor was about double that of the one built by contract, while in the case of the pair most favorable to the contract system the one built by day labor cost nearly four times as much as the one built by contract.

The Relative Cost of Cleaning Catch Basins by Day Labor and by Contract.—A study was made of the cost of cleaning catch basins by day labor and by contract. This study included the cost of cleaning nearly 9,000 catch basins, at a total expense of $54,000. The cost of doing this work by day labor averaged $6.39 per catch basin, or $2.47 per cubic yard of refuse removed from the basins, while that done by contract cost $4.15 per basin, or $1.46 per cubic yard.

Forms of Water Bills.

To the Editor of MUNICIPAL ENGINEERING:

SIR—As requested in the last number of MUNICIPAL ENGINEERING I am sending

herewith duplicates of bills actually sent out from this office December 1, 1909.

J. H. CHILD, Supt and Eng.
Board of Water Commissioners,
Wallingford, Conn.

The form for the flat rate bills is given below. The sheet is perforated so that the memorandum at the right is detached for office use when the bill is receipted. On the bill is stamped "5 per cent. discount will be allowed if payment is made on or before Dec. 23, 1909."

The form for meter bill is the same, the three blanks in the lower left hand corner being filled with the readings and the amount consumed. A slip giving the meter rates is endorsed in the bill. These rates are as follows:

city should from time to time be informed by the law department in written reports of the status of every case in which the city is a party. An office should be provided in the city hall in which the records of all the city cases should be preserved, and the law officials should report at said office at stated times daily, and there be accessible for consultation by any of the other city officials on the city business. —Mayor George Gonzales, Hoboken.

Are these suggestions of value to your city? Does your mayor or the head of your law department himself receive "written reports of the status of every case in which the city is a party"?

BUREAU OF MUNICIPAL RESEARCH,
New York.

Wallingford, Conn., December 1, 1909.

M. O. H. D. Fowler
369 Center Street,
Wallingford, Conn.

No.	Class	Annual Rate
1	Family	$5.00
1	Bath Tub	3.00
1	Water Closet	3.00
	Sprinkler	
	Horses	
	Cows	
1	Automobile	2.00
	Market	
	Miscellaneous	

To Wallingford Water Fund, Dr.

From June 1st, 1909, to Dec. 1st, 1909, $ 6.50
Abatement,
Received Payment,
Collector.

State of Meter,
Last Statement,
Cubic ft.

Office Hours: June and December, Tuesdays, Thursdays and Saturdays, from 7 to 9 P. M. Remaining Months, Thursdays, from 7 to 8 P. M.

$ 6.50

M. O. H. D. Fowler
369 Center Street.

For the first 15,000 cubic feet of water used within the period of six months, the sum of

			$1.50	per M.
Next	10,000	feet	1.25	" "
"	15,000	feet	1.00	" "
"	20,000	feet	.90	" "
"	40,000	feet	.85	" "
"	100,000	feet	.75	" "
"	100,000	feet	.65	" "
"	250,000	feet	.55	" "
"	250,000	feet	.45	" "
"	250,000	feet	.35	" "

Over this amount 25 cents per 1,000 feet.

Opposite are the forms of flat rate and meter bills in use at Sherbrooke, Ont., W. B. McCaw, Secretary of Water Department.

The opposite form of notice of meter bill in use in Olathe, Kan., is printed on a postal card, the treasurer's stub being semi-perforated so as to be easily detached.

Service Reports and Balance Sheets for City Law Departments.

The law department of this city (Hoboken) has been conducted in a very unsatisfactory manner. The mayor of the

Wheeling's Brick Streets Must Be Sprinkled, Not Flushed.

The following is a copy of an ordinance passed during the year 1909 in connection with the use of water in sprinkling or flushing streets in Wheeling, W. Va.

An Ordinance Requiring the Use of a Sprinkler in Watering the Streets Paved With Brick.

Section 1. Be it ordained by the Council of the City of Wheeling, That it shall be unlawful for any person to use a hose in sprinkling or throwing water upon the streets paved with brick in the city of Wheeling without having attached to the nozzle upon such hose, or otherwise attached to such hose, a sprinkler, so that the water passing through such hose shall be distributed upon the street instead of being thrown from the hose in one volume.

Section 2. Any person violating the provisions of this ordinance shall forfeit and pay to the city of Wheeling a fine of not less than one dollar nor more than five dollars, in the discretion of the police court of the city of Wheeling, and shall also pay the costs of the prosecution.

Water Bills are Payable on or before the 20th May, August, November and February.

M_____Street

WATER BILLS are payable three months in advance, on the first days of Feb., May, Aug. and Nov., and must be paid by the 20th, at the CITY OFFICE, Brooks' Block, Opposite Post Office.

To the Sherbrooke Water Works, Dr.

☞ Persons vacating premises must give notice at the Water Works Office, as they are held responsible till such notice is given.

For Three Months Water Supply from Feb. 1st to May 1st, 1910 $_____

Make Cheques Payable to "City Water Department." Arrears $_____

If Bill is not paid in Twenty Days after presentation, the supply of Water will be cut off and will not be turned on again except upon payment of 50 cents, charges for shutting off and turning on the Water, in addition to amount of Bill.

Keep your Taps and Fixtures tight. Water will be cut off if found leaking.

Make Cheques Payable to "City Water Department."

*M*_____

To The City of Sherbrooke Water Department, Dr.

For Water Supply BY METER, Three Months ending

State of Meter . . .

" " Last Settlement . .

Consumption . . . . Cubic Feet

Equal to . . . Gallons @ . cts. per 1,000 gallons

Rent of Meter . . . . .

THIS BILL MUST BE PAID WITHIN TEN DAYS

This Card Must be Presented when Paying Bill.

Office of

ASSESSOR OF WATER RATES

CITY COUNCIL ROOMS

Olathe, Ks.

DEAR SIR:

Your last meter reading was . . . . . .

Previous meter reading was . . . . . .

Cubic feet consumed . . . . . .

. . . . . Gallons at . . . . . per thousand amounts to $ _____

This amount is due and payable at City Treasurer's Office at Olathe State Bank, from 1st to 10th, inclusive. No bill will be sent you. Receipt will be mailed when check for the above amount reaches the treasurer's office.

Respectfully,
L. R. SYKES, Assessor.

N. B.—City Ordinance requires payment of water bill on or before the 10th of each month. If not paid by the 10th water will be cut off without further notice.

Ent	Paid	Name
$		

TREASURER'S STUB

Floods in the Seine and the Ohio.

At the regular monthly meeting of the Engineers' Society of Western Pennsylvania, held March 15, President E. K. Morse appointed a committee to report on the question of raising the bridges over the Allegheny river at Pittsburg.

The importance of the questions involved, both engineering and financial, may be realized from the fact that there are eight bridges affected, over a river averaging 1,000 feet in width, the majority of which would be replaced in toto.

A paper on "The Floods in the River Seine" was read by Thos. P. Roberts of the U. S. Engineer's Office, Pittsburg. The author pointed out the peculiar soil conditions in the Seine basin, tending usually to restrain floods, but occasionally tending to prolong and increase the volume of their discharge. He made very interesting deductions from the following table:

Rivers.	Area of Basin, Sq. Mi.	Cubic Feet per Second.			Discharge Sec. Ft. per Sq. Mi. of Water Shed.		
		Approx. High Water.	Usual Low Water.	Extreme Low Water.	High Water.	Usual Low Water.	Extr'me Low Water.
Seine above Paris	15,000	60,000	2,640	1,200	4 00	0.176	0.080
Monongahela above Pittsburgh	7,391	160,000	400	175	21.65	0.054	0.024
Ohio at Pittsburgh	18,644	350,000	2,500	1,400	18.77	0.134	0.075

Note—In March, 1907, the Monongahela reached a discharge of 230,000 cubic feet, and the Ohio at Pittsburg 430,000 cubic feet per second. Doubtless during the late Paris flood the Seine at Paris reached or exceeded a discharge of 100,000 cubic feet per second.

Mr. Roberts referred to the very permeable nature of the soil in the Seine basin, three-quarters of its area being chalk, which gives rise to countless springs, and pointed out that these conditions, together with the Marne and other "equable" tributaries of the Seine, are capable in the aggregate of keeping up a long protracted medium flood stage at Paris, which, in 1876, lasted fifty-five days, owing to the very slight slope of the Seine below Paris, preventing a rapid carrying away of the water.

The author pointed out that owing to these conditions there arises at long intervals possibility of serious disasters in the Siene valley, which is unusually level.

During these weeks of high water to which the chalk country may furnish a large and persistent volume, a second rain storm may traverse the Yvonne, Neivre and Cote d' Or country, the bad third of the Seine basin, which is an elevated wooded region with extensive exposures of limestone, where, in places, rain water rapidly sinks to reappear in notably large springs. This local rainfall may not be very great, but it furnishes a sudden and sufficient increment on top of the medium flood to bring about gravely serious conditions.

Referring to suggestions made for governing flood conditions in France, by means of reservoirs, the author pointed out that nature is now illustrating at Paris one of the possible mishaps attending the use of reservoirs, as the chalk and gravel beds forming splendid reservoirs are letting out too much water which can not be controlled, for it is probably the case that, owing to the nature of the soil and topography, few sites can be found for large artificial reservoirs.

The matter of forestation was commented on, as were the projects looking to the enlargement and shortening of the Seine from Paris to the sea.

Model Form for Report of Water Works Department.

The waterworks department of Sherbrooke, Ont., W. B. McCaw, secretary, sends its financial statement for 1909, with the forms of bills which are reproduced on another page. There is also included a similar statement of the city gas and electric department. The waterworks statement is reproduced herwith. The statement of the department is similar in form, but is not so fully detailed. On account of lack of space, some of the items are condensed. The financial statement is as follows:

EXPENSES.

Interest		$12,487.50
Genral maintenance and repairs		3,362.28
General expenses (stationery), advertising, postage, etc		663.15
Maintenance and repair pumps		647.73
Wages		5,880.25
Annual sinking fund	$6,250.00	
Interest earned on sinking fund	1,099.44	
		7,349.44
Interest earned and deposited to special sinking fund		398.81
Depreciation		4,000.00
Net profit per year		2,085.64
Total		$36,874.80

RECEIPTS.

Water sold	$35,208.09
Material sold	71.23
Interest earned on sinking fund	1,099.44
Interest earned on special fund	398.81
Interest earned on current deposit	97.23
Total	$36,874.80

The balance sheet is as follows:

Assets—Value of water system, December 15, 1908.....	$313,250.87
Additions during 1909 in the following items: Wheel, pipe, labor, meters, wages at dam, lumber, general expenses at power, boarding house, wages on pipe line, cement, new pump, valves, services, concrete, new pump house, road, land, heating plant, making a total of.....	33,038.53
Value December 15, 1909, $346,289,40; less deprecation, $4,000	342,289.40
Special sinking fund.....	9,273.40
General sinking fund.....	49,820.14
Bills due	6,227.33
Cash on hand	718.27
Materials on hand, pipe, $3,286.95; valves, $88.....	3,374.95
Services	358.62
Total	$512,061.86
Liabilities—Bonds of the city of of Sherrooke	$392,500
General sinking fund.....	49,820.14
Special sinking fund.....	9,273.15
Loan from special sinking fund..	6,000
Profit and loss.....	44,468.57
Total	$412,061.86

W. B. McCaw,
Secretary Water Department.

Traction Engine Hauling Wagons Out of Gravel Pit.

The accompanying photograph shows a novel method of taking gravel out of a deep pit, adopted by Hiram W. Reed, of Mishawaka, Ind. The pit is about 30 feet deep and the teams and empty Studebaker dump wagons are driven in at one side of the pit. The teams are then unhitched and driven out, leaving the wagons in the pit. When loaded they are pulled up the steep incline by a traction engine. Although the grade is so steep that it is difficult for the teams to get up the bank, the engine hauls the wagons out with ease though loaded with 1½ cubic yards of gravel.

HAULING STUDEBAKER DUMP WAGONS OUT OF GRAVEL PIT WITH TRACTION ENGINE.

Laboratory to Study Lake Michigan Pollution.

The establishment of a temporary laboratory at Hammond, Indiana, for the purpose of making tests and arriving at some scientific conclusion which will throw some light on how to solve the question of the pollution of the water of Lake Michigan by the sewers of Hammond, Gary, Whiting and East Chicago, is proposed by the food and drug laboratory of the State Board of Health of Indiana. At a recent meeting at the Chicago Board of Trade, in

Chicago, April 2, attended by the mayors of the Indiana cities interested, the question was discussed. The Indiana mayors agreed to take any reasonable steps to prevent pollution of the waters, but wished to know how it could best be done, and it is to answer this question that the state board will equip its temporary laboratory in Hammond.

Houston Park Commission.

A park commission has been created at Houston, Texas, to obtain for that city additional public parks to meet the demand of increasing population. The city has three public parks, two of which are yet to be equipped and beautified. Mayor Rice nominated William A. Wilson, George Hermann and Edwin B. Parker park commissioners, and council confirmed them.

Cost of Pole Line for 3-Phase System.

The following table of costs of three-phase system pole line per mile is taken from an article in the General Electric Review, and is compiled from actual figures submitted by operating companies in the localites indicated:

POLE-LINE COSTS PER MILE FOR 3-PHASE, 2,300 OR 6,600-VOLT.

No.	Item.	Omaha.	Kan. City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-foot poles...	$275.00	$287.50	$200.00	$200.00	$171.00	$180.00	$218.90
50	Pole hardware.	10.00	7.10	16.00	12.50	8.30	7.40	10.25
50	Cross-arms, 2-pin	17.50	7.25	11.50	15.00	17.00	16.00	14.00
150	Insulators	16.50	6.00	11.20	6.00	6.75	7.00	9.00
	Labor setting...	80.00	90.00	200.00	125.00	55.00	100.00	109.00
	Labor stringing wire	25.00	15.00	40.00	50.00	30.00	40.00	35.00
	Incidentals	25.00	41.00	50.00	30.00	10.00	20.00	30.00
	Totals	$449.00	$453.85	$528.70	$438.50	$297.05	$370.40	$426.15

These figures do not include painting and are exclusive of bookkeeping, overhead charges, and the like.

MUNICIPAL MATTERS IN COURT

Higher Courts—Damages for Taking Creek Water—Excessive Expenses—Sidewalk Merchandising Ordinance—Bitulithic Decisions

Decisions of the Higher Courts of Interest to Municipalities.

BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Exemption of Municipal Corporations from Liability for Defects in Public Buildings.—In exempting a municipal corporation from liability for defects in its public buildings used for public or governmental purposes, or the negligence of its employes in their care, the law places them on the same footing with the state and counties thereof as to buildings owned and used by them in aid of government.—Schwalks, Adm'r. v. City of Louisville (Ky.) 122 S. W. 860.

Maintenance of Noxious Garbage Dump by City.—Liability on Theory of Nuisance.—A city acts in its individual, and not in its governmental capacity in disposing of garbage and is liable as an individual for creating and maintaining a nuisance in so doing, so that it would be liable to an adjoining owner, irrespective of negligence, where it established a garbage dump on its own land, the noxious odors from which made it uncomfortable and dangerous to reside on adjacent land.—City of Paris v. Jenkins (Tex. Civ. App.) 122 S. W. 411.

City Responsible for Funds Permitted to Be Paid to Officer Not Entitled to Receive Them.—Where a city contracting for the construction of a local improvement at the cost of property benefitted thereby permitted its comptroller to receive money in carrying out the work, the city must answer for his malfeasance, though under the charter public funds were not payable to him.—City of Seattle v. Stirrat, (Wash.) 104 P. 834.

City Not Liable for Negligence of Contractor in Work Collateral to Contract.—A municipal corporation is not liable for

the negligence of an independent contractor, if such negligence consists in some fault or omission wholly collateral to the performance of the work to be done, and not necessarylly involved in it.—Powell v. City of Waterloo, (Iowa) 123 N. W. 346.

Injury to Pedestrian from Obstruction in Street—City's Liability—Duty to Keep Streets Safe Can Not Be Delegated.—An independent contractor, constructing a cement extension to a sidewalk over a parkway to meet the curb, placed stones around it and a wire about two feet from the ground. A passer after dark, there being no lights, ran into the wire and was injured. *Held*, that the city was liable, since its duty to keep the walk in a safe condition by warning lights could not be delegated to an independent contractor.—id.

Appointment of Commissioner to Construct Bridge—Limitation of Authority.—Though the fiscal court can not delegate to an agent the discretion with which the law clothes it, it may, after determining the necessity therefor, appoint a commissioner, not a member of the court, to construct a bridge or contract for its construction, but it should in advance direct through its records the character of the bridge and its cost, and not allow the commissioner a round sum for the work, or leave to his judgment the character of the work and the cost, or allow him to obtain the money in advance for the doing of the work, either by a sale or assignment of the warrants therefor, or collecting from the county treasurer.—Milliken v. George L. Gillum & Son, (Ky.) 122 S. W. 151.

Construction of Defective Sewer System—City's Liability to Property Holders. A municipality constructing an unsuitable sewer system, without first duly adopting a plan, is liable for damage to property, because of the insufficiency of the system. * * * * Though a city is free from negligence in the adoption of plans for and in the construction of a sewer system, it is liable the same as in case of want of ordinary care in its installation, where the system proves not to be reasonably suitable, and it fails to remedy the deficiency within a reasonable time after notice thereof, either actual or constructive.—Hart v. City of Neillsville, (Wis.) 123 N. W. 125.

Right of City to Sell Water to Manufacturing Plant Located beyond its Boundaries.—Conferring the power on a city to sell water service to a manufacturing plant located beyond its boundaries, by Sp. Laws 1905 (P. 87 C. 6, Sec. 252), denying the city power to grant the use of any public utilities operated by it to anyone living beyond its limts, with an exception in favor of manufacturing plants, is not a grant of a thing of value to such a plant, which Const. Art. 3, Sec. 52 inhibits the legislature from authorizing a city to make.—Sturgeon v. City of Paris (Tex. Civ. App.), 122 S. W. 967.

City May Delegate Power to City Engineer to Locate Subdrains for Sewers.—Where a city providing for the construction of a sewer system, provided for subdrains to protect the system and determined the total length of the subdrains and the materials to be used, the fact that the city engineer had discretion to determine only where the subdrains should be placed did not render the proceedings void because delegating power to the city engineer to direct the manner and extent of laying the subdrains.—Hildreth v. City of Longmont (Colo.), 105 P. 107.

Acceptance of Tract with Plat Showing Extension of Street is a Dedication.—Where a plat of a tract partitioned, showing the extension of a street through the tract, was attached to the court's decree, and consented to by all parties at the time of the decree, and thereafter recognized by subsequent conveyances in conformity therewith, the parties' acts constitute a dedication of the tsreet.—Hunter v. City of Des Moines (Iowa), 123 N. W. 512.

Claims for Removing Refuse from Sewers Limited to Estimated Expense.—Greater New York Charter (Laws 1901, P. 50, C. 466) Sec. 149, requires the borough president to certify the estimated expense of executing contracts to the comptroller, and thereby limits the expenditures under a contract for removing refuse from the sewers of Brooklyn to the amount of such estimated expense, and where the amount of refuse exceeds the estimated quantity, the contractor has no claim against the city for its removal, though removed by him under a written order of the borough president.—Dondon Contracting Co. v. City of New York, 119 N. Y. S. 617.

Charter Provision Requiring Affidavit of Publicity of Ordinance.—A city charter provision that an ordinance after passage, shall not go into effect until recorded with an affidavit of publication in a designated book must be complied with before the ordinance can have any efficacy. —Hager v. Malton (W. Va.) C. 6, S. E. 13.

Motives of Council in Passage of Ordinance Can Not Be Inquired Into.—In passing an ordinance for a street improvement the council acts in a legislative capacity, so that the motives of its members can not be inquired into by a court for the purpose of determining the validity of the ordinance.—Gardner v. City of Bluffton (Ind.) 89 N. E. 853.

Charter Provision Limiting Ordinances to one object—Construction.—Seattle City Charter, Sec. 10, providing that every ordinance shall contain but one object, which shall be clearly expressed in its title, does not forbid the law-making body from passing an ordinance having a general object and bringing within its scope any number of subjects germane to the general subject, the provision being to prevent the union of disconnected matters, and an ordinance providing for the con-

demnation of lands for streets and parks, for an assessment of private property specially benefitted, to be made in the manner provided by law for raising the just and equitable proportion to be assessed upon private property, and providing that any part of the compensation, damages or costs that is not finally assessed against private property shall be paid from the general fund of the city was for the geenral object of condemning property for public use with details for carrying out the general object and was proper under the charter.—City of Seattle v. Sylvester Cowen Inv. Co. (Wash.) 104 P. 1121.

Operator of Subway Under Contract with City Exempt from Taxation.—Tax Law (Laws 1896, P. 796, C. 908, Sec. 2, as amended by Laws 1899 P. 1589, C. 17), making a special franchise of a railroad to construct or operate its line above, on or under public streets, real estate for the purpose of taxation, does not deprive the operator of a subway of the exemption from taxation declared by the rapid transit law first contained in the amendment by Laws 1894 (P. 1884, C. 752, Sec. 35, and substantially re-enacted by Laws 1900, P. 1360, C. 616, Sec. 35) providing that the operator of a subway shall be exempt from taxation in respect to his interest therein under the contract with the city for its operation and in respect to the rolling stock and other equipment.—Order (1908) 110 N. Y. S. 577, 126 App Div. 610, affirmed.—People v. State Bd. of Tax Com'rs., 89 N. E. 1109.

Water Company Failing to Provide Adequate Service—Receiver May Be Appointed.—When a water works company holding a municipal franchise had become insolvent, and had failed to provide wholesome water or sufficient pressure required by the franchise ordinance, and its water works system had been permitted to decay, the court was authorized, at the suit of the city, to forfeit a franchise and appoint a receiver.—Gainesville Water Co. v. City of Gainesville (Tex. Civ. App.), 122 S. W. 959.

Obstruction of Natural Drains By Railway Crossing.—The prohibition against the obstruction of natural drains having always been a part of the law, where a railroad acquires a right of way crossing natural drains, it did so sub modo; the condition being that it would not obstruct the drains.—Petit Anse Coteau Drainage Dist. v. Iberia & V. R. Co. (La.) 50 S. 512.

Condemnation of Property for Pipe Lines—Compensation.—The measure of compensation for the right to lay and maintain a pipe line along a railroad right of way across the owner's land is, in the absence of evidence that the strip has peculiar adaptability for a pipe line, the fair market value of the property at a fair and voluntary sale.—Color Oil & Gas Co. v. Franzel (Ky.), 122 S. W. 188.

Ordinance Declaring Brickyard a Nuisance—Held Void.—An ordinance declaring a brickyard, where bricks are burned within 1,200 feet of a residence, or a public school, or a city park a nuisance, unless permitted in the one case by the owner of the residence or in the other by the city, is void, for unreasonableness.—City and County of Denver v. Rogers, (Colo), 104 P. 1042.

When a Band Stand in the Street is a Nuisance.—A band stand in the street is a "continuing nuisance," where so long as it remains and is used for the purpose of its construction, it will interfere with merchants in their business, and hence injunction will lie against it after its completion.—Atterbury v. West (Mo. App.), 122 S. W. 1106.

City Liable for Injury at Street Fair.—A person injured while attending a street fair by being pushed from the steps leading from a platform, which steps led from the entrance to a tent to the open street, is entitled to recover from the municipality which has authorized the holding of such fair in such manner, notwithstanding the person so injured was not using the street in question for the purpose of travel.—(1908) Van Cleef v. City of Chicago, 144 Ill. App. 488, judgment affirmed (1909), 88 N. E. 815.

Damages for Taking of Creek Water by Cement Factory.

An opinion was filed recently by Vice-Chancellor Howell in a suit brought against the Edison Portland Cement Company by a property owner of Warren county, New Jersey. The plaintiff, who owns a grist-mill of 100 years standing, brought suit to enjoin the cement company from depriving her of the use of the water of the creek by the operation of the cement plant. In denying the allegations in the complainant's bill the cement company supplemented its answer with a cross-bill, praying that the complainant be enjoined from further proceeding with an action at law begun by her. The petition further asked that it be decreed, in case the complainant be entitled to a writ of injunction, what amount of compensation, if any, should be awarded to the complainant as just and equitable in lieu of the issuance of the writ of injunction prayed for by the plaintiff. Vice-Chancellor Howell, says in part:

The suit in this court is for an injunction to prevent the defendant (Edison Portland Cement Company) from future disturbance of the complainant's right. The common law action is an action for past infractions of the same right. What the defendant is now seeking to do is (1) to stay the suit for past damages; (2) to have it determined by this court whether the defendant is now or has been in the past guilty of a violation of any right of the complainant to flowage of water, and (3) if this court finds that there is such an infraction of the complainant's right that it will ascertain the extent and character thereof and award to the complainant such damages as she

may be entitled to, which damages the defendant stands ready to pay.

As a question of pleading, it may be said that the answer must always support the cross-bill. There is a variance between them in this case which must count strongly against the defendant. The answer denies all the injury complained of, while the theory of the cross-bill is that the defendant is committing a continuous trespass on the rights of the complainant, and that it desires to continue the same trespass indefinitely, and to pay therefor such sum as this court may assess.

If the defendant is guilty of the charge laid to its door, it is depriving the complainant of a valuable right in the waters of the creek, and this right is property to which the complainant is entitled.

Shortly then, the case under the cross-bill takes upon itself the aspect of an attempt to take private property for private uses upon such compensation being made as this court may award. This, of course, is not to be thought of. There is no proceeding known to the law by which one man can take the property of another for the private use of the taker, no matter what rate of compensation may be offered. This would be an interference with vested rights and can not be permitted.

It will be observed that there is no contract between these parties upon which the cross-bill can be predicated, nor is there any equity alleged by which the bill can be supported, except that the jurisdiction invoked may be exercised to prevent a multiplicity of suits. I do not understand that the doctrine touching the power of this court to interfere with a multiplicity of suits extends to the case made by the cross-bill. In short, what the defendant says is this:

"I am committing a most flagrant disturbance of the right of the defendant for which she is suing me. I desire to continue my trespass and to enjoin her suits for damages, not because I have any right in her land, but because she is bringing actions to defend the title to her property, which I want and am willing to pay for."

Laches was also set up in the cement company's answer, and concerning this the vice-chancellor says:

The fact that the complainant lay still and made no complaint for a period of two years, during which time the defendant took water from the stream, may have been sufficient laches to have justified the court in denying to her the provisional relief which he sought, but is she to be deprived of the title to her estate because she did not bring suit immediately upon the beginning of the trespass?

Excessive Expenses of Ashokan Reservoir Commissioners.

A decision handed down by Justice Chester, of the New York Supreme Court, allowed $2,000 to each member of three of the Ashokan reservoir condemnation commission, making a total of $18,000, with expenses aggregating over $3,400.

Objection to the bill rendered was made by the New York Corporation Counsel. Justice Chester, commenting on the city's objection to certain disbursements for automobiles used by the commissioners in visiting property sought to be condemned for the purpose of viewing it, says he agrees "that these charges are large, and that automobiles should not be employed against the objection of the city where it is possible to reach a point reasonably near the property by railroad; but early in these proceedings a custom grew up under which the assistants employed by the then Corporation Counsel made arrangements to provide commissioners with automobiles; after the Corporation Counsel's office had inaugurated this method for getting the commissioners to the property it is hardly fair to deny them the expense they have actually incurred in following that custom until after they have been notified that disbursements for automobiles in the future would be objected to."

Justice Chester criticised the custom of paying commissioners upon a per diem basis. "Under that system," he says, "there has been an evident disposition to prolong the work of the commissioners to an undue length. There is nothing in the law providing for compensation on that basis."

Sidewalk Merchandising Ordinance Valid.

In a decision rendered by Judge Snyder, of the Superior Court, at Washington, D. C., the ordinance regulating the display and sale of merchandise on the public streets of the city was held as both valid and reasonable.

The ordinance was recently passed by the city council and provides that no one shall be permitted to sell goods or solicit trade on the street, or display merchandise for sale except on shelves that shall not extend more than eighteen inches over the sidewalk. At the time the ordinance was passed it was generally admitted by the members of the city council that it was intended to apply to the one firm of S. A. Pierce & Co., shoe dealers, who utilized a considerable portion of the sidewalk in front of their store for the sale of goods and kept an employe on the outside to attend to the street sales.

Counsel for the Pierce firm contended that the ordinance was invalid because the title was defective and the measure itself was unreasonable and discriminating, and that it had been drafted and passed at the instance of the firm's competitors.

In overruling the motion to dismiss Judge Snyder announced that in his opinion the title was good and that he failed to see wherein the provisions of the measure were unreasonable and discriminating, in that they were intended to apply to all merchants.

Court Decisions on Bitulithic Pavement.

Three recent court decisions involving bitulithic pavement are of considerable interest.

One was in the New York Supreme Court, Richmond county, and refused an injunction against awarding a contract for bithulithic pavement on Fingerboard Road, and stated that fair and reasonable

opportunity for competition had been presented; that asphalt had designedly been omitted from the specifications, because a rougher pavement was needed on account of the steep grades; and because bitulithic where laid in similar localities had proved itself satisfactory and durable.

The second decision was by the New Jersey Supreme Court on a writ of certiorari to review a contract between Trenton and the United Paving Co. for paving Princeton avenue with bitulithic. The writ was denied on the ground that competitive bids could be received on a patented pavement as shown in Newark vs. Bonnell, 28 Vt. 424; Ryan v. Paterson, 37 Vr. 533, and Bye vs. Atlantic City, 44 Vr. 402, and that the choice of the Warren Brothers Company's formulae for the mixture was probably for the purpose of making it reasonably certain that the wearing surface furnished would be the genuine bitulithic article.

The third decision was by the Court of Common Pleas of Lucas County, Ohio, in the case of Speckert against the City of Toledo and others to restrain the letting of a contract to the Central Bitulithe Co. It refused the order on the ground that the failure to sign the bid until after it had been opened was immaterial since bond and affidavit were duly signed, being an oversight on the part of the agent of the company, and the board acting within its authority in permitting the signature later; that the failure o tfhe clerk to read the bid publicly did not matter, and that a substantial compliance with the formality of the law was all that was required; and that the company was the lowest bidder on bitulithic, though not the lowest bidder on any kind of material offered, and the board acted within its rights in selecting bitulithic as the paving material and letting the contract to the lowest bidder on that material.

MUNICIPAL AND TECHNICAL LITERATURE

An Acknowledgment—Municipal Reports—New Publications

Municipal Reports.

Report of the President of the Borough of Manhattan, New York City, for 1909. George McAneny, Pres.; Geo. W. Tillson, Chief Engineer of Highways.

The major part of the report is that of the department of highways. Much more work was done in 1909 than in 1908, the total of street paving and maintaining expenditure of $3,506,934 being nearly 3½ times as much in 1909 as in 1908. Most of the difference appears in the repaving, which was about 4 times as much in 1909 as in 1908, and in the new Riverside drive extension, on which $625,037 was expended. Notwithstanding all this work, the increase in mileage of improved streets, as shown in the 1909 report, was only 3.5 miles, and if one refers to the 1908 report, there was an actual decrease of 0.26 mile, there being a discrepancy in the two reports of 3.4 miles of macadam. The mileage of street pavements is now 258.80 of sheet asphalt, 47.82 of asphalt block, 87.62 of granite block, 10.73 of wood block, 29.53 of old stone block, 4.63 of macadam, a total of 439.13 miles. Contracts for 9.5 miles are not yet completed.

Granite block is the favorite where the traffic is heaviest. First avenue from 20th to 59th, formerly asphalt with an abandoned repair contract, was repaved with granite.

The widening of 5th avenue 15 feet with asphalt was made from 25th to 48th street. More than half the paving of the year was with sheet asphalt.

Asphalt block was used on grades and on petitions in the northern part of the island. About 80 per cent of the paving of the year was of asphalt, including sheet and block.

About two-thirds of a mile of wooden block paving was laid on petition. The only complaint about this pavement is its slipperiness, and its use on more than 2 per cent grades is therefore not recommended. The specifications for treating blocks were changed and the price was reduced, probably in consequence.

The average area of asphalt streets kept in repair during the year was 1,905,420 square yards.

The borough built 1.67 miles of sewer in 1909, increasing the mileage to 523.34. Of these sewers 248.8 miles were cleaned at a cost of $362.45 a mile.

An Acknowledgment.

One of the new magazines devoted to the improvement of cities from the standpoint of the citizen rather than of the official connected with the actual carrying out

of the work of physical improvement is *The American City*, which is edited by Arthur H. Grant, with a large advisory board. The numbers which have been received indicate a single-hearted devotion to the cause which should bring results. One of the recent articles was by Walter B. Snow, of Boston, and demonstrated the excessive cost of city work done by day labor in that city and the reasons therefor. This article was accompanied by some graphic illustrations which showed clearly to the eye the points made by the writer. Through the courtesy of Mr. Snow and *The American City* these illustrations were used in the March number of MUNICIPAL ENGINEERING with an article upon the same subject, but acknowledgment of our indebtedness was omitted inadvertently and is now made with great pleasure.

New Publications.

Accounting Every Business Man Should Know. By Elisha Ely Garrison. Cloth, 188 pp. $1.20 net, postage 12 cents. Doubleday, Page & Co., New York.

The author states that his purpose in this book is "to explain away the obscurity which frequently hides the real values and purposes of accounting." Briefly, he "explains the principles of business operation and finance," and as "simply," perhaps, as is possible with a subject so complex. For one who has the genius for accounting, though not expert in its details, he perhaps "clears away all obstacles," but to the ordinary mind he simply admits a light which shows the importance of the subject and the necessity of a broad view, as well as of expert attention to details.

If the book has faults they are in that it attempts too general a statement and presents the difficulties too often in advance of the place for their solution, so that a single reading is likely to leave an impression of confusion. The cross-references are so explicit, however, that a second reading, making the applications of the subsequent solutions to the difficulties as they appear, should bring order out of the mass of partly related ideas derived from the first reading.

The first chapters give a brief survey of the probable development of the processes of bookkeeping, giving an account of the origin and foundation ideas of accounts, the transition to modern methods, and the theory and practice of the ledger. After some discussion of the characteristics of accounts, the author takes up the separation of accounts into classes to be taken care of by various methods in cash books, records and ledgers of various designs, such as inventory, expense and revenue ledgers, department costs, etc. In more detail he discusses the fundamental principles of cost accounting, the devising of systems to suit the demands of the particular business, the governing ledger, the statement of the results of the operation of the business, the relation of the manager to the accounting system and the knowledge which the directors should have of it, and how they should obtain it.

One who fully understands all the statements and allusions in the book has already become an expert accountant, at least in theory, and the author is evidently doubtful of producing this effect upon all his readers, for he frequently emphasizes the necessity of procuring the assistance of expert acountants to prepare and install systems of accounting, to audit books, to interpret statements, balance sheets, etc. The book is worth the no small trouble of reading it with reasonably complete understanding if the reader gains a knowledge of the possibilities of pit falls in statements and balance sheets and some idea of how and where to look for them.

Concrete Inspection. A manual of information and instructions for inspectors of concrete work with standard and typical specifications. By Charles S. Hill, C. E. Cloth, 179 small pages, $1 net. The Myron C. Clark Publishing Company, Chicago, and New York.

Mr. Hill is a compiler of books who exercises judgment, and within the rather restricted limits he has set himself he has made a good collection of information, instructions and standards for inspectors of concrete.

The book begins with a chapter on the duties of the inspector in receiving concrete materials, cement, sand, aggregates and water and the methods of determining quickly their conformity with the specifications. The second chapter is on proportioning and mixing and gives the inspector many practical hints and instructions, one of the most important of which is to report perculiarities to his chief and find out what is required of him. Form work, lumber, workmanship and removal; reinforcement and methods of placing; the placing of concrete; joining of old and new work, and procedure in water and in freezing weather; details of methods of sidewalk construction; molding and driving concrete piles, each has a brief but comprehensive chapter.

Standard specifications are given as follows:

From the American Society for Testing Materials for cements.

From the American Railway Engineering and Maintenance of Way Association for Portland cement concrete and reinforced concrete.

From the building ordinance of St. Louis, Mo., for concrete building.

From the National Association of Cement Users the proposed standard building regulations for the use of reinforced concrete; for sidewalks; for hollow building blocks.

From the Concrete Steel Engineering Co., for material and workmanship for arch bridge construction.

ORGANIZATIONS AND INDIVIDUALS

Technical Meetings—Technical Schools—Personal Notes

Technical Meetings.

The annual convention of the Illinois Mayors' Association will be held at Cairo, Ill., May 18 and 19. The program includes the following papers: "Finances and Accounting of Cities," Hon. Edmund J. James, president University of Illinois; "Public Service Corporations and Their Control," Mayor N. T. Rawleigh, of Freeport; "Enforcement of Ordinances," E. S. McDonald, ex-mayor of Decatur; "Public Health and Sanitation," Dr. W. A. Evans, health commissioner of Chicago; "The Construction, Repair and Maintenance of Pavements," Clark G. Anderson, city engineer of Moline, Ill.; "Duties of Public Officials," Mayor Silas Cook, East St. Louis, Ill.

The next convention of the Indiana Municipal League will be held in Richmond, Ind., June 21, 22 and 23.

The annual convention of the Southwestern Electrical and Gas Association will be held at Beaumont, Texas, May 12, 13 and 14.

The annual meeting of the Appalachian Engineering Association will be held at Winston-Salem, N. C., May 6 and 7. Henry M. Payne, secretary, Morgantown, W. Va.

The semi-annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers will be held at Cincinnati, Ohio, May 19 and 20. F. E. Sanborn, secretary, Ohio State University, Columbus.

At the meeting of the Municipal Engineers of New York city, April 27, Wm. G. Ford read a paper on "The Development of Jamaica Bay Into a Harbor for New York City." The society hopes to have a hundred responses so that it can make an inspection trip to the General Electric works at Schenectady, the Albany filtration plant, and the large lift lock at Cohoes.

The annual meeting of the National Electric Light Association will be held at St. Louis, Mo., May 23, 24, 25, 26, 27 and 28. T. C. Martin, secretary, 29 West Thirty-ninth street, New York City.

The spring meeting of the American Society of Mechanical Engineers will be held at Atlantic City, N. J., May 31, June 1, 2 and 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

The annual convention of the Engineers' Society of Pennsylvania will be held at Harrisburg, Pa., June 1, 2 and 3. E. R. Dasher, secretary, Gilbert Building, Harrisburg, Pa.

At a meeting of the Canadian Society of Civil Engineers in Montreal, April 7, a paper by H. S. Hancock, Jr., on "The Fort William Water Supply," was read by R. S. Lea.

A committee made up of representatives appointed by twelve different engineering societies has recommended the construction of a building for the scientific and engineering societies of Boston, similar to the Engineering Societies' building in New York City. Letters are being circulated to ascertain the membership possibilities for the new club. The societies represented on the committee are as follows:

Boston Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Architects (Boston chapter), National Electric Light Association (New England section), New England Association of Gas Engineers, Illuminating Engineering Society (New England section), New England Street Ry. Club, New England Water Works Association, American Chemical Society (Northeastern section), Society of Chemical Industry, Telephone Society of New England.

The annual convention of the American Society of Civil Engineers will be held in Chicago, Ill., June 21, 22, 23 and 24. Chas. W. Hunt, 220 W. Fifty-seventh street, New York City.

The annual convention of the Society for the Promotion of Engineering Education will be held at Madison, Wis., June 23, 24 and 25. Henry H. Norris, secretary, Cornell University, Ithaca, N. Y.

The annual convention of the American Institute of Electrical Engineers will be held at Jefferson, N. H., June 27, 28, 29 and 30. R. W. Pope, secretary, 33 West Thirty-ninth street, New York City.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 28, 29, 30, July 1 and 2. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

The New England Water Works Association held a special meeting in Hartford, Conn., April 13. President King announced that the date of the annual convention, which is to be held in Rochester, N. Y., has been changed from September 14-16 to September 21, 22 and 23. The

cleaning of water mains, secondary water supplies, and forestry were the subjects discussed.

The annual convention of the American Water Works Association is in session as this number of MUNICIPAL ENGINEERING goes through the press. Report of the proceedings will appear in the June number.

The second national conference on city planning and the problems of congestion will be held in Rochester, N. Y., May 2, 3 and 4.

Technical Schools.

The April number of the Clarkson Bulletin gives the description of courses of study, equipment, facilities, etc., of the usual school catalog for the School of Technology at Potsdam, N. Y.

The forest products laboratory at the University of Wisconsin, Madison, Wis., will be opened formally on June 4. The university furnishes building, light, heat and power and the United States forest service the equipment, apparatus and 35 or 40 men to carry on the work. A number of vacancies in wood preservation, testing and chemical engineering work will be filed in May and June.

Union College, Schenectady, N. Y., opened its new general engineering building April 28.

"Unit Coal and the Composition of Coal Ash," by S. W. Parr and W. F. Wheeler, is issued by the Illinois University Engineering Experiment Station as Bulletin No. 37. This is a report of a series of experiments on coal, together with a tabulation of calculated values for unit coal for Illinois, Ohio, and other coal regions of the United States. The results show great constancy in the value of unit coal for any given mine or region, nothwithstanding the fact that the value of the natural coal as mined may vary between wide limits.

"The Weathering of Coal,' by S. W. Parr and W. F. Wheeler, is issued by the Engineering Experiment Station of the University of Illinois as Bulletin No. 38. This bulletin embodies the results of weathering tests conducted on car-load lots of coal for a period of one year, in the course of which coal from various mines was exposed in covered bins, open bins and under water. The results are presented in the form of charts which show graphically the losses in heating value resulting from each condition of exposure.

The tenth annual session of the Summer Schools for Engineers and Artisans, under direction of the College of Engineering of the University of Wisconsin, opens June 27th, continuing for six weeks. Advanced courses are offered in Direct and Alternating Currents, Hydraulics, Machine Design, Descriptive Geometry, Applied Mechanics, Shopwork, Steam and Gas Engineering and Surveying. Elementary courses for artisans, and those not having preparation for the advanced work, are offered in Applied Electricity, Engines and Boilers, Fuels and Lubricants, Mechanical Drawing, Machine Design, Materials of Construction, Shopwork and Surveying. The teaching staff is taken from the regular instructional force, and all laboratory equipment of the engineering college is available for students. For bulletin or further information address F. E. Turneaure, Dean, College of Engineering, Madison, Wis.

Personal Notes.

J. W. Mellor has been elected mayor at Sedalia, Mo.

J. P. Leggett has been elected mayor at Carthage, Mo.

J. B. Bullard has been elected mayor at Topeka, Kans.

Emil Seidel has been elected mayor at Milwaukee, Wis.

Robert E. Lee has been elected mayor at Springfield, Mo.

Hon. William Gilbert has been re-elected mayor at Laurel, Md.

W. U. V. Spencer has been elected mayor, at Webb City, Mo.

Samuel A. Carlson has been re-elected mayor at Jamestown, N. Y.

Morgan R. Butler has been elected city engineer, at Waukesha, Wis.

John W. Budd has been reappointed city engineer at Des Moines, Iowa.

Charles J. Baumgartner has been elected city engineer at Dubuque, Iowa.

Hon. Alvah P. Clayton has been re-elected mayor of St. Joseph, Mo.

Otto Matthews has been elected mayor and Zarna Patton councilman at Macon, Mo.

Ferdinand V. Wolfe, former mayor of Dover, N. J., died suddenly in that city, April 22.

William McGuilsery and William O. Kunkle have been elected aldermen at Carthage, Mo.

Dr. Tenney has been elected mayor, P. A. Turton clerk, and G. Ryffet treasurer at Alma, Mich.

Darius A. Brown has been elected mayor of Kansas City, Mo., succeeding Hon. Alfred F. Evans.

Thomas Fitzpatrick, J. O. Strubingle, and W. R. Wilson have been elected aldermen at Barry, Ill.

Edward L. Smith has been elected mayor at Hartford, Conn., succeeding Hon. Edward W. Hooker.

R. A. Hatfield, Miles Harrison, Gilbert Keith and M. F. Buckley have been elected councilmen at Trenton, Mo.

Theodore A. Leisen has been re-elected chief engineer and superintendent of water works, at Louisville, Ky.

John S. Filmley, Perry Hasslman, John Swadon and W. E. Kneeland have been elected aldermen at Griggsville, Ill.

Captain John E. Whittlesey, former mayor of Houston, Texas, died at his home in Washington, Conn., recently, aged 79 years.

E. F. Stebbins has been elected mayor and B. F. Harris, D. M. Ward, L. J. Karfenberger, and W. C. Brown aldermen at Lebanon, Mo.

William J. Welch, formerly water commissioner at Boston, Mass., has been reappointed to that position, succeeding William E. Hannan.

Louis W. Anderson, who recently resigned as city engineer of Grand Rapids, Mich., has formed a partnership with Charles J. Carpenter, under the firm name

of Carpenter & Anderson, and will conduct a general engineering and construction business.

A. A. Faucett has been elected mayor at Tacoma, Wash., and will be the first to serve under the commission form of government in that city.

E. W. Brown has been elected mayor, F. H. Farwell, B. G. Brown and Joe Weaver, aldermen, and K. A. Mitchell, secretary, at Orange, Tex.

Merritt H. Smith, M. Am. Soc. C. E., has been appointed deputy engineer of the board of water supply, New York City, to succeed Charles L. Harrison, resigned.

J. S. Worley, Kansas City, Mo., has been appointed a member of the commission to appraise the water powers of Michigan not already taken over by private corporations and individuals.

E. F. Ayers, of Beaumont, Tex., has been appointed state highway engineer for Oklahoma. A roads laboratory will be established at the Oklahoma Agricultural and Mechanical College, Stillwater.

T. H. Brannon, formerly assistant engineer, department public service, Columbus, Ohio, has been promoted to be engineer in charge of streets in that city, and will be succeeded by R. C. Chaney.

Mr. C. S. Davidson, a specialist in hydraulic and concrete work, has become associated with Mr. E. C. Crum, civil engineer and constructor, Frederick, Md. They will continue to do all classes of municipal and railway engineering and constructing, under the firm name of Crum & Davidson, at the present offices of Mr. Crum.

J. H. Titus has been appointed city engineer, to succeed J. H. Matthews, resigned, at Arkansas City, Kans. Mr. Titus has been consulting engineer on sewers and pavements for the city for the last six months.

Benjamin K. Hough has been appointed Boston sales manager for the Wisconsin Engine Company, of Corliss, Wis. He will have offices in the Oliver building, Boston, and will represent the company in the New England states.

Andrew W. Woodman and Albert B. Moore, of Chicago, have formed a partnership for the practice of civil, mechanical and electrical engineering, under the firm name of Woodman & Moore, with offices at 184 La Salle street.

H. J. Arrive has resigned as superintendent of water works at Houston, Tex., and will establish an office for general consultation and water works construction work. John B. Williams has been appointed to succeed Mr. Arrive.

John B. Gordon, Assoc. M. Am. Soc. C. E., has been appointed assistant engineer of the department of sewers at Washington, D. C., to succeed T. C. H. Baily, M. Am. Soc. C. E., who has been appointed enegineer in charge of street extensions.

MACHINERY AND TRADE

Bitu-Mass for Roadways.

Perhaps the most interesting of the processes for producing a good pavement for roads and lightly traveled streets at a low price is Bitu-Mass, on which has been spent two or three years of time and effort in developing the material, the process and the machinery for making the pavement. It is too long a story to tell at once, but some of the basic principles can be stated, to be followed by details of history and results.

The theory upon which the process has been developed is that heating the materials found in the roadway oxidizes organic matter and drives it off making the material equal to clean sand or broken stone. Muck or very fine loam could hardly be treated satisfactorily, but the material usually found on roadways in active use comes through the heating process in good condition for use in the new road surface. The specifications provide for the addition of gravel or broken stone and sand in case the old road surface is short of such materials.

The heated aggregate is mixed with heated bitumen, laid on the roadway and thoroughly compacted, producing a durable, smooth but not slippery, noiseless and dustless pavement.

The machine which produces this result is an important adjunct of the process. It is shown at work in the accompanying photograph. Projecting from the end of the machine is seen the chute leading materials to the rotary dryer. The end of the chute is covered by a screen which rejects everything more than one inch in diameter. The material from the old road surface, mixed with gravel or sand if necessary, is shoveled upon the screen and the material finer than one inch passes into the machine. No further handling is required, all of the machine operations being automatic until the paving mixture is dropped into wheelbarrows to be dumped in place on the subgrade and rolled into a finished wearing surface. The furnace for heating the material is located on the farther end of the machine, and all of the hot air and products of combustion are drawn through the dryer by the blower shown in the picture on the rear end of the machine, and the dust is collected in the Cyclone dust collector,

BITU-MASS ROAD MAKING MACHINE IN OPERATION.

also seen in the photograph, so that the machine is not a nuisance on the street. The dried and heated material discharges into a hopper at the farther end of the dryer and is carried by an automatic conveyor to a duplicate measuring box so that one side can fill while the other side is emptying. Near this box is another duplicate measuring device for the bitumen which flows from the heating kettle into one side or the other. The measuring boxes for dry material and hot bitumen discharge together automatically into a mixer of the usual design, and when the mixture is made thoroughly it is dumped into wheelbarrows.

The machine is self-propelling, is moved along as the pavement is laid, and this insures hot material in the roadway. It is 29 feet long, 10 feet in greatest width and in greatest height. The machinery is run by a 20 horsepower engine behind the vertical boiler seen in the photograph. The capacity of the outfit is 55 to 60 cubic yards in a 10-hour day.

The process of laying the pavement begins with the scarifying of the old surface, which is then removed to sufficient depth to give the desired finished surface when the pavement is completed, and deposited along the side of the roadway. An 8-ton roller is used for compacting the subgrade, and is later used after a 2½-ton roller in compacting the bituminous wearing surface. The material deposited along the road is then run through the heating and mixing machine, with such additional sand and gravel as may seem desirable, and, when deposited in place by the wheelbarrow, is rolled to a smooth, even surface in a compact layer by the rollers. For a country road the bituminous layer is ample if 4 inches thick. The thickest city street yet laid is 5 inches deep.

The company developing the pavement now has several streets of various ages and amounts of traffic, which demonstrate its excellent qualities and its adaptability to the various conditions of traffic. Some further description of these streets and of the adaptability of the construction to first-class country roads will be given later. Meantime the American Paving and Construction Co., Commercial Club building, Indianapolis, Ind., will supply any details desired regarding this very meritorious method of meeting the most pressing demand upon modern road constructors for a surface that will stand under automobile traffic and is reasonable in price.

The Stocker Washing Machine for Concrete Materials.

Many times materials for concrete, such as gravel, sand or crushed rock, are too dirty to pass specifications or to make good concrete and clean materlais can be obtained only at great cost. In such cases an economical method of washing the materials is a great saver of cost and conserver of materials.

The Stocker Concrete Material Washer Company, of Highland, Ill., has patented a washer which will wash about 75 tons of material in ten hours, containing as much as 20 per cent. of clay, at an expenditure of 10 to 15 gallons of water a minute. It will remove all materials that will dissolve or float in water. When water is scarce it can be run from the machine to settling basins and used over again. It is operated by a 2-horsepower gasoline engine and a pump would be necessary if water of sufficient pressure is not available.

The drum of the washer is about 8 feet long and 30 inches in diameter and has a chain drive. The material is put in at one end, is stirred up by the revolution of the drum, which is fitted with riveted angle-irons on the inside and steel strips forming elevators which carry the material to the upper part of the drum, whence it drops into stationary steel chutes, which drop it back into the water to be taken up by the elevator and dropped into the next chute until it is finally discharged from the machine. The clean water enters at the discharge end of the drum and discharges at the other end.

Other sizes of the washer are also made and elevators for placing the washed material are also attached if desired.

Reports of the practical uses of the machine are very favorable, and it should in many cases save much in the cost of work where naturally clean materials are not readily available. The company will give full information about the machine on request.

Acme Corrugated Metal Culverts.

From an article on "Experience with Pipe Culverts of Corrugated Iron," describing this form of drainage conduits in detail, the following description of the Acme culvert is extracted. It shows the good points of this culvert and its durability. The new catalog will be sent on request.

The Acme corrugated metal culvert, made by the Canton Culvert Co., of Canton, Ohio, is so designed as to enable it to be shipped either set up complete, or in semi-circular sheets nested together and ready to be erected in the field. The sheets have interlocking flanged ends, which are bolted together, forming two longitudinal ribs. The culvert is so made that the flanges provide ample bearing surface, while the bolts prevent spreading at the joint. The circular seams are made by lapping the corrugations, the upper and lower sheets breaking joints. An advantage of this construction is that the sheets can be nested and packed in bundles for convenience of transportation. For special purposes, flat corrugated bottom plates may be used, making a culvert of semi-circular section.

Perforated corrugated plates are used in some cases for the upper half of drains or

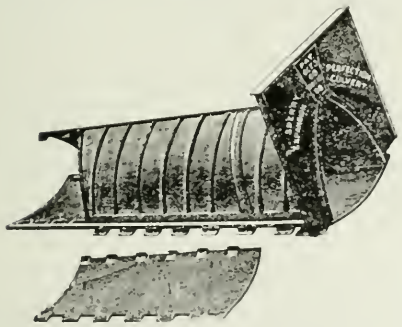
culvert of both circular and semi-circular section, the plates being made for diameters of 8 inches to 36 inches. These plates have ½-inch holes of 4 inches pitch (staggered) in the valleys of the corrugations. After being punched these plates are galvanized by the hand-dipped process so that there are no exposed edges.

The sheets are made of a special galvanized material, termed "No-Co-Ro" metal, and the company states that the manufacture (from the furnace to the finished product) is under its supervision and direct management in its local mill connections. Comparative tests with solutions of sulphuric acid are said to have showed a rust-resistance five times higher than that of charcoal iron and over sixteen times that of steel.

The "Acme" culverts have been used extensively in this country, and to some extent in other countries. They are made in diameters of 8 inches to 6 feet, with metal of Nos. 16, 15 and 14 U. S. gage for the smaller sizes, and Nos. 12 and 10 gage for the larger sizes. The sheets are in 26-inch lengths, with 2-inch laps, making a finished length of 24 inches. It is estimated that when properly laid a life of 20 to 25 years may be expected.

Sperry Expansion Culverts.

The Portsmouth Machine and Casting Co., Portsmouth, O., has placed on the market a patented cast iron culvert, which presents some new and interesting features in culvert construction. In its design the inventor has endeavored to secure a culvert which will not only fill all the requirements of a road culvert, but one which will reduce the cost of maintenance to a minimum. Being made of cast iron, it is practically impervious to the action of rust, which makes it much more durable than the average metallic culvert. It is made in short sections (the longest being three feet), which connect up together to make any desired length. This feature makes the culvert easy to ship, easy to handle and easy to place in position.



SPERRY ROAD CULVERT.

Expansion is provided for by the use of curved tongues on the side walls and slotted holes along the edges of the bottom by means of which the base and sides are locked together, yet leaving sufficient play to prevent breakage by the action of either frost or traffic. Nor is it possible for the culvert to settle out of line. In case of washouts or freshets, a Sperry culvert may be carried away, as any culvert might, but because of its sectional construction it may easily be reassembled and replaced. The capacity is said to be slightly more than that of a corresponding size of round pipe, owing to the greater pressure on the broad base. Its great strength is shown by the guarantee under which it is sold, to withstand the weight of a 20-ton road roller with a cover of six or more inches of good road bed, or the strains of heaviest railroad loadings with a cover of four feet or more. For ordinary interurban traction purposes two to three feet of cover is usually sufficient.

The culvert has been quite extensively used in the east for several years, and has been adopted by one of the leading railroads in New York state. For tramway and county road construction it has also become quite popular in certain districts. In appearance, the culvert is neat and ornamental when in place, the head walls allowing any desired dressing of banks or overfill.

The Portsmouth Machine and Casting Co., Portsmouth, O., has the exclusive manufacturing sales rights in several states.

The Story of Market Street, Philadelphia.

Probably never in the history of American cities has a matter of street pavement loomed so large in the public imagination, or become so widespread a subject for intense partisanship, as the case of Market street in Philadelphia, during the past season. For a year or more Market street was in chaos on account of the building of the subway. Traffic had been greatly reduced on account of the rough going, and pedestrians were avoiding the thoroughfare on account of the dirt and confusion. Market street is the center of the retail shopping district of Philadelphia, and its merchants suffered enormous losses through the diversion of traffic to other streets, as well as in the difficulties and delays in shipping and receiving goods.

When the subway at last was covered in and the question of pavement came up, the Market street merchants got together and formed an association, including practically all the retailers on the street, for the purpose of protecting their interests and seeing to it that Market street was paved with a pavement that would attract traffic and accord with the comfort and convenience of pedestrians. The old Market street pavement had been granite blocks, and the merchants wanted no more of it. Granite block pavement was rough, frightfully noisy, and not easy to clean. Sentiment among the merchants at first was for asphalt or brick, as these were the only smooth pavements with which they were then familiar. Then came the suggestion of wood block pavements, and

a committee was sent to other cities, especially New York, to get pointers on the subject. It returned enthusiastic for wood block pavement, on the ground that it was quieter than brick or asphalt, much more durable, and very clean.

The next step of the merchants was to employ a firm of pavement testing experts to prepare a special report and to recommend the pavement that would best suit Market street conditions. The experts submitted an elaborate and complete report, covering the paving field with great care from the standpoints of durability and other desirable qualities. The report was entirely unbiased. The facts reported were highly favorable to the wood block proposition.

By this time the merchants were unanimous, and they began making vigorous representations to the city council and the mayor, and forced the city authorities to investigate the subject themselves. At the same time they stimulated newspaper discussion, and before long the entire town was talking about pavement stresses, pavement guarantees, etc., and the wise citizens were explaining to the rest how a wooden street could be made that would last longer than stone. Public sentiment soon came to favor the wood block pavement as strongly as the merchants did, and the largest wood block pavement contract that has yet been let in this country was finally signed by the mayor.

While the pavement was being put down the work was regarded as one of the sights of the town. Thousands of citizens who had fought for the pavement came to witness the laying of the first block with appropriate ceremony. So watchful were the people that the discovery of an occasional imperfect block in the piles on the sidewalk caused a "tempest in a teapot" for a day, until the matter could be satisfactorily explained in the newspapers.

After the pavement was completed and the barriers removed, traffic flooded into Market street as never before. Philadelphians found that it made pleasanter pavement to ride over; pleasure vehicles began to use the street in great numbers; and for pedestrians it immediately became the favorite street in the city. The remarkable reduction in noise made it a pleasanter place to walk; one turned into the street with a feeling of relief after the uproar of neighboring stone pavements.

The Christmas shopping season brought to the Market street merchants a record business, and they openly and repeatedly testified in the newspapers and elsewhere that the new pavement had been responsible for it, and had made Market street the favorite haunt of the shopping public.

Their satisfaction was shown again in February when the city was visited by a committee of Chicago officials, who were making a tour of the large cities to investigate and inspect various kinds of street pavements. The Market street merchants took the trouble to entertain them and appeared before them with enthusiastic indorsement for wood block pavement. Mr. Ellis A. Grindell, one of the big merchants, said that from the beginning he felt confident that it was the ideal pavement for business streets, and that the campaign entered into by the merchants had been fully justified by results. Mr. Ralph Blum declared that the claims of the merchants that wood paving was sanitary, clean and noiseless and in every way adapted to the needs of business houses, have been already demonstrated Mr. J. R. C. McAllister, chairman of the Finance Committee of the Council, told of a popular measure he had introduced in councils providing for wood paving on all the central streets of the city. He said, "I can safely predict that in less than ten years the entire business district of this city will be paved with creosoted wood blocks." This measure was backed up by the merchants in an elaborate resolution in which they said: "As a means of attracting the shopping public, enhancing property values, facilitating transaction of business, the installation of the silent and sanitary wood paving such as we have on Market street has already demonstrated its efficiency to the thorough satisfaction of practically every business merchant."

At the present time petitions are before the authorities for other downtown retail streets, especially Walnut and Chestnut streets, urging an extension of wood block pavement. It seems likely that with this powerful public sentiment in favor of wood, the aspect of Philadelphia will be radically altered within the next few years.

Where Trench Braces Are Necessary.

BY C. P. BLACKISTON.

Trench braces were brought into novel and effective use in Youngstown, Ohio, recently when that city was visited by a severe cyclone and cloudburst, one to be long remembered.

Along one of the principal thoroughfares of the Buckeye city a large water-main was being placed, the excavating having just been completed at heavy expense. When the cloudburst happened along, the engineer in charge, perceiving the danger to his trench, ordered a dam of planking built along the upper side, braced by Bunn pipe-expansion trench braces, which were being used.

Before the heavy downpour was long in progress, the wisdom of the engineer was seen. From the steeply graded cross-streets came a raging torrent, carrying with it all manner of debris from above. The improvised dam formed an immovable barrier. The braces would not give an inch, so the rush of water was checked, the trench was unharmed, and incalculable damage to property on the lower side of the street was averted.

A case quite similar to that above happened the other day in Pittsburgh, when a large water-main burst in Highland Park. The water, given its freedom, rushed down over the terraces and over the right of way of the Allegheny Valley Railroad, blocking all traffic for several hours.

Workmen finally succeeded in building a temporary dam in front of the break, closing the gap by means of Dunn trench braces.

For such emergencies as these the Dunn braces are advantageous beyond the ordinary uses and strains placed upon a trench brace owing to its pipe extension features and machined threads, insuring easy operation. The ball and socket bases of these braces makes it possible to operate them in any position.

Methods of Testing Creosote Oils.

The Bulletin No. 65 of the American Railway Engineering and Maintenance of Way Association, giving the methods of testing creosote oils prescribed in the standard specifications for wooden block pavements adopted by the Organization for Standardizing Paving Specifications, can be obtained for 50 cents of the secretary of the association, E. H. Fritch, 962 Monadnock block, Chicago, Ill.

Imperial Waterproofing.

A. F. George Company, of Los Angeles, Cal., has perfected a waterproofing preparation for concrete which has successfully stood some severe practical tests. A letter recently written to the manufacturing company by the Board of Supervisors of Los Angeles county shows the results of one of these tests.

Los Angeles, March 21, 1910.

It gives us pleasure to make a statement concerning the efficiency of Imperial Waterproofing.

When you offered to stop the flow of water coming into the court house elevator tunnel, running from New High street to the court house elevator, we looked upon your proposition as a huge joke, as the water was flowing like springs in a great many places all over the roof of the tunnel, but today there is not a particle of water flowing into the tunnel, or any indications of water whatever; besides, you have improved the appearance of our tunnel one hundred per cent., and the small amount of expenditure we have made in applying the waterproofing is very much appreciated by the public.

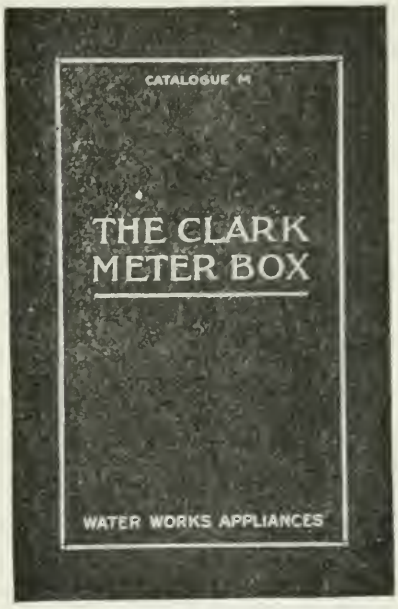
Imperial Waterproofing is certainly a wonder, and if it is permanent as you claim, it is certainly one of the most valuable commodities on the market.

Signed by C. D. Manning, H. D. McCabe, S. T. Eldridge, C. J. Nellis, R. W. Pridham, Board of Supervisors, Los Angeles County, California.

Imperial waterproofing can be applied on the surfaces with a brush or mixed in with the concrete. It will not discolor the materials on which it is used, but can be colored, if desired, by the use of indelible dyes. It is very penetrative and combines with the material, so that it will not crack or peel.

The Clark Meter Box.

The accompanying cut shows the cover of the new catalog of H. W. Clark Company, Mattoon, Ill. It gives a history of the development of the box, a full description of the present forms and the methods by which it is adapted to all conditions—frost of the north and warm weather of the south. Many styles of covers and lids are shown, meeting all requirements;



also collapsible forms for making the box bodies, meter couplings, service box keys, inspectors' and special gauges.

Mr. Clark is a water works superintendent with many years of experience, and his inventions are the outgrowth of the conditions he has met, and they are therefore eminently practical.

One of the interesting things in the catalog is the description of Mr. Clark's method of operating deep wells, and the apparatus which he has developed to increase the economy and certainty of the service.

He will send copies of the catalog on request, including the price list and telegraphic codes.

How Portland Cement Is Made.

The writer has been reading with great interest the description of the method of making Portland cement, which appears in a booklet describing "A Little Journey

to Our Mills at Superior, Lawrence Co., Ohio," which is issued by the Superior Portland Cement Co., Union Trust building, Cincinnati, O., and wants to recommeend it as both interesting and valuable to any one who uses Portland cement, no matter whether he is interested in the particular kind of cement or not. But one who reads the booklet can scarcely fail to become interested in the product of so excellent a plant, using such excellent materials. Send for the booklet in any event. It is worth the trouble and the stamp many times over.

Nordell Sewer Slide Rule.

The Nordell sewer slide rule has been designed to overcome the difficulty and avoid the usual labor incident to finding the time of running in sewers. It is so arranged that if the length, drop and size of a sewer are known, one setting will give the time required to flow the given length. By its construction the necessity of reducing to a rate per cent in order to find the capacity of a sewer is also avoided.

The rule is based upon the Chezy formula, Kutter's formula being used to determine the value of *c*, and it applies to circular sewers only. Correct positions on the scale are worked out for the coefficient of friction N equals .013 and .015 for brick or concrete sewers, and N equals .013 and .011 for pipe sewers. Different coefficients may be proportionately interpolated if desired.

The determination of run-off in sewers has been, from the beginning of storm-water sewer design, based very largely on empirical formulas, which give correct results only for areas identical with those from which they were derived, because some very important factors in determining the run-off, such as the shape of the area drained, the manner of collection and the time of concentration are left out of consideration entirely.

The main advantage of the Nordell sewer slide rule lies in the fact that it simplifies the application of the more correct methods of storm-water run-off determination involving the time of concentration in sewers. Heretofore the labor of finding this factor has been such that engineers would turn to empirical formulas giving doubtful results, rather than to a method involving the time of concentration, as without the use of this slide rule the velocity must be obtained from tables which involve a product of several factors, and the time in minutes then found by dividing the length of a sewer by the velocity in feet per second and reducing to minutes.

To further increase the value of the rule, it has been made in the duplex type. All graduations which are intended to be used purely for sewer calculations are upon one face of the rule, while the reverse face has the regular 20-inch A, B, C and D scales for computations of a more general character.

The use of the rule is as follows: Suppose at a certain point a quantity of 100 cubic feet per second is to be discharged through a sewer 700 feet long, whose coefficient of friction is .015. If 700 on the left-hand L scale is set under the required quantity, 100, on the cubic feet per second scale, the different drops required by various sizes of sewers may be read off on the left-hand H scale over the divisions corresponding to the sizes on the line N equals .015. If the coefficient of friction were assumed as N equals .013, the rule would be set as before, but the required drop would be read on the left-hand H scale over the division on the line N equals .013. It will be seen by the form of the rule that any coefficient may be interpolated by drawing lines connecting the corresponding divisions on N equals .013 and N equals .015 and also a horizontal line at a proportional distance between the other coefficient lines. By using the runner to project the intersections to the H scale the rule is read as before.

Suppose the sewer to be established and the time of running wanted. The method of procedure is as follows: Find the drop of the sewer on the right-hand H scale and set it over the division corresponding to the size on the line representing the assumed coefficient of friction. The time in minutes may then by read off on the T scale over the division corresponding to the length on the right-hand L scale. With the same setting the velocity in feet per second may be read off by looking over the length on the left-hand L scale and dividing the reading by 10, as indicated by the supplementary red figures.

The scales are adjusted for the sewer running 0.8 full, a point where the velocity is practically the greatest and the discharge 98 per cent of the discharge running full, thus providing for a maximum rapidity of collection with a margin of carrying capacity. A "Parts Full" scale is provided for converting the discharge for other depths of flow on the left-hand side and a similar scale for converting the time and velocity on the right-hand side of the rule.

The rule is made by Keuffel & Esser Co., 127 Fulton street, New York.

Trade Publications.

Berkshire pamphlet No. 1, by Albert Moyer, gives specifications for using White Portland cement mortar.

The H. Mueller Mfg. Co., Decatur, Ill., announce that "Summer's Comin'," in a new catalog showing their water main tapping machines, cocks and connections, flange work, meter testers, strainers, regulators, tools, etc. It is a condensation of the Mueller catalog showing the lines of goods most in demand at this season. It will be sent on request.

The Stone & Webster Engineering Cor-

poration has printed an elaborately illustrated account of their enargement of three power stations for the Boston Elevated Railway Company, under the title "Came the Power with the Need."

The ten business commandments and an added eleventh as the Lehigh Portland Cement Company would have it, are the latest from the Indianapolis office of the company. The concrete dry dock of the Toledo Ship Building Company is the subject of another pamphlet.

Bulletin 71 of the Universal Portland Cement Company is largely devoted to reinforced concrete buildings. Another bulletin gives the results of an investigation of cement drain tile with full evidence of their lasting qualities. Reproductions of the Universal advertisements in the Chicago papers during the cement show are also distributed.

Standard road oil is fully described in a handsomely illustrated pamphlet issued by the road department of the Standard Oil Company of New York, 26 Broadway. Asphalt road oils, emulsifying road oil, macadam asphalt binder, oilers, distributers, topping oilers, pipe sprinklers, the Saybolt road oil distributer, hand sprinklers, heaters, tank cars and wagons are all shown. Specifications in detail for oiling roads, for asphalt and bituminous macadams are given in full. Copies of the booklet will be sent on application to interested persons.

Circular No. 13 of the Ashland Steel Range and Manufacturing Company, Ashland, Ohio, shows briefly but clearly and completely the advantages of their U. S. standard concrete block machines, the appearance of buildings made of them, the structure of the U. S. standard continuous concrete mixers and the make up of the various sizes and styles sold by the company. It will be sent on request.

Aquabar, "the absolute and reliable waterproofer," sold by the Girvan-Nachod Co., general sales agents, 1228 Locust street, Philadelphia, Pa., is well described in a circular and some attached letters from satisfied users.

Jeffrey roll crushers are shown in Bulletin No. 39 of the Jeffrey Mfg. Co., Columbus, Ohio.

Edison Aggregate for April is devoted to churches, schools and theaters.

Trade Notes.

ASPHALT.

Spokane, Wash.—The Inland Empire Hassam Paving Co. has been incorporated and will enter into the paving business here. The incorporators are Martin Woldson, Daniel G. Munro, Charles E. Swan, W. A. Lucy and George M. Ferris.

BRICK.

Steubenville, Ind.—The Steubenville Brick and Tile Co. has been incorporated to manufacture and sell clay brick and drain tile, by Chester C. Klink, Robt. Lacey, and Alvin Goodwin.

Mt. Clemens, Mich.—The Miller Vitrified Brick Co. has been incorporated and will erect a paving brick plant.

Oakland, Cal.—The Oakland Paving Brick Co. has been incorporated.

Albion, Ill.—The Albion Shale Brick Co. has been organized and will build a paving brick plant here.

Hudson, N. Y.—A company is being organized to erect a plant for the manufacture of shale paving brick.

El Reno, Okla.—The El Reno Vitrified Brick and Tile Co. has been incorporated by A. E. Lane, Harry Lane, A. C. Krepke and N. A. McLean.

Tulsa, Okla.—The Tulsa Paving and Building Brick Co. has been incorporated by Geo. W. Rose and others.

CEMENT.

Winnipeg, Man.—The Central Portland Cement Co., Ltd., has been incorporated by William Fox, Valdimar J. Melsted, of Minneapolis; Chas. Blake, Leonard Cashmore, and Henry F. Tench, of this city. The business offices are located here.

Erie, Kans.—Seth G. Wells, ex-state auditor and receiver of the Chanute Cement and Clay Product Co., announced that he would sell the entire plant at Chanute at public sale on April 15.

CONCRETE BLOCKS.

Findlay, O.—Tarbox & McCall have purchased machinery and will erect a building for the manufacture of cement and drainage tile.

Deer Lodge, Mont.—(Special). H. B. Grant, city engineer, advises us that he is interested in designs of concrete buildings.

PURCHASE OF MACHINERY.

St. Paul, Minn.—Sealed bids are asked until 2 p. m., May 2, for furnished a road roller. Geo. T. Reddington, secretary, board park commissioners.

St. Louis, Mo.—(Special). W. C. Reed, 3800 Park boulevard, is in the market for a concrete mixer, brick hoist, wire rope, sheaves, etc.

Whitman, Mass.—(Special). A. P. Trufont is in the market for an attachment for a sprinkling cart to apply light oil or heaviest grade of tar.

Chicago, Ill.—(Special). Theodore Ohlborn, 932 Greenwood Terrace, is in the market for contractors' equipment; also cement, sand, stone, gravel, asphalt, tar and sewer pipe.

Wilmington, O.—(Special). L. L. Compton, P. O. building, desires to investigate cement tile machines, post and brick machines.

PURCHASE OF MATERIALS.

Creston, Ia.—(Special). Theodore S. DeLay, city engineer, desires the addresses of all producers in this country of tar cements suitable for the construction of bituminized macadam roadways.

LIGHT, HEAT AND POWER.

Buffalo, N. Y.—The Myers Gas Generator Co. has been incorporated to manufacture and deal in machinery operated by gas, etc., and manufacture and deal in all kinds of gas machinery and fixtures, by C. H. Myers, P. L. Marvin and J. H. Schumaker.

MISCELLANEOUS.

Chattanooga, Tenn.—The Municipal Engineering and Construction Co. has been incorporated by W. A. Sadd, Joe Brown, Frank Sperlock, A. D. Glover and Foster V. Brown.

Patents Concerning Sewers and Drains.

858,638. Tile Mold. John J. Swenson, Roswell, N. M.

873,634. Concrete Tile Mold. Wm. S. Thomas, Eaton, Colo.

887,225. Manufacture of Concrete and Like Pipes. Olof Kjellstroem, Stockholm, Sweden.

889,440. Reinforced Concrete Pipe. Chas. H. Cartlidge, LaGrange, Ill.

893,328. Centering for Concrete and Tile Construction. Wm. S. King, San Francisco, Cal.

893,695. Concrete or Cement Pipe. Edward H. Ames, Columbus, O.

894,517. Concrete Pipe. Coleman Meriwether, Montclair, N. J.

895,904. Tile Mold. Howard A. Smyth and Otto Perschbacher, Wichita, Kan.

896,835. Apparatus for Cleaning Sewers. John Kelly, Jamaica Plains, Mass.

898,205. Drainage System (from gutters). Karl Filskow, New York, N. Y.

898,428. Cement Pipe Making Machine. Herman Besser, Alpena, Mich.

903,022. Sewer Cleaning Apparatus. Wm. H. Stewart, Boston, Mass.

904,033. Concrete Mold. Wm. B. Weldon, Chicago, Ill.

904,900. Mold for Forming Concrete Drain Tile. Samuel L. Sheets, Paris, Ill.

905,646. Machine for Making Cement Drain Tiles. John Cardiff, Potomac, Ill.

906,034. Sewer Cleaning Apparatus. John Kelly, Jamaica Plains, Mass.

906,953. Metallic Culvert. John E. Sperry, Munnsville, N. Y.

907,159. Cap for Sewer and Other Pipes. Geo. O. Miller, North Tonawanda, N. Y.

909,027. Metal Drain Pipe. Joseph A. Sanders, Cayuga, Ind.

909,344. Sewer Pipe. Chas. M. Stratton, Toronto, O.

909,354. Sectional Conduit. Wm. G. Wight, Yale, Mich.

910,577, 910,578. Method and Apparatus for Molding and Laying Concrete Pipes. Ernest L. Ransome, New York, N. Y.

911,321. Sewage Ejector. Wm. McClintock, New York, N. Y.

911,368. Road Culvert. Louis Blakestad and Ole A. Anderson, Lyle, Minn.

912,318. Reinforced Concrete Pipe Structure. Harry R. McMahon, Cleveland, O.

912,428. Block for Sewer Construction. Chas. H. Slocomb, Hartford, Conn.

912,638. Culvert Pipe. Carl O. Wold, Minneapolis, Minn.

913,036. Sewer Pipe Coupling and Connection. Mads Nelson, Canton, O.

913,131. System for Ventilating and Purifying Sewers and the Like. Edward T. Head, Sudbury, Ont.

913,662. Composite Pipe. John T. Langford, Newton, Mass.

914,032. Expansible and Contractible Core for Making Cement Conductors (pipes). Mathias Engeln, McHenry, Ill.

914,066. Sewer Trap. Ben Oakes, Detroit, Mich.

914,110. Culvert. Henry A. Brownell, Flint, Mich.

915,086. Culvert Pipe. Sam T. Ferguson, Minneapolis, Minn.

915,266. Culvert. David C. Boyd, Galion, O.

915,640. Press for Making Sewer Pipe and the Like. Calvin W. Vaughn, Cuyahoga Falls, N. Y.

916,587. Reinforced Concrete Pipe Coupling. John M. Phelan, Jackson, Mich.

916,654. Sewer Pipe Cleaner. Scott E. Barwis, Altoona, Pa.

917,892. Sewer Cleaning Apparatus. Wm. A. Pierce, Boston, Mass.

918,030. Culvert Mold. Wm. C. Fife and Stanley R. Coleman, Carson City, Mich.

918,723. Culvert (metal). Chas. F. Alt, Warren, Pa.

919,997. Corrugated Metallic Culvert. John Zelch, St. Paul Park, Minn.

920,317. Mold for Making Cement Concrete Pipes.

921,497. Mold for Concrete Culverts. Thos. B. Abercrombie, Welden, Ia.

924,553. Mold (Cement Tile). Lorenzo D. Irish, Mason, Mich.

925,019. Culvert. Morden F. Parks and Oswald Parks, Cahac, Mich.

928,265. Culvert. Gilbert Mahoney and Frank A. Reunds, LeRoy, Minn.

928,606. Conduit (Road drain). Willard Houghton, Brinnon, Wash.

928,812. Machine for Making Concrete Tiling. Ransom Z. Snell, South Bend, Ind.

928,826. Underground Conduit (Concrete). Sylvester B. Way and Elisha C. Freeze, St. Louis, Mo.

928,938. Means of Cleaning Sewers. Frank A. Cerrute, New York, N. Y.

929,644. Concrete Manhole or Catch Basin. Parrott G. Harshbarger, Hyde Park, Mass.

Patents Concerning Sewage Disposal.

860,930. Apparatus for Separating and Purifying Sewage and the Like. Erich Mertens, Berlin, Germany.

875,984. Portable Apparatus for Liquefying and Purifying Sewage. Fredk. J. Commin, Exeter, Eng.

890,433. Sewage Disposal Apparatus. Wm. C. Matthias, Reading, Pa.

891,742. System of Sewage Disposal. Fred P. Smith, Kansas City, Kan.

895,229. Method of Treating Sewage. Cecil C. E. Beddon, Wallingford, Pa.

904,141. Apparatus for Discharging the Contents of Septic or Settling Tanks and the Like. Samuel F. Miller, Chicago, Ill.

904,324. Sewage Distributer. John W. Hartley, Stoke-upon-Trent, England.

909,340. Liquid Controller. Wm. S. Shields and Jas. W. Cox, Chicago, Ill.

917,663. Septic Tank. Henry C. Rogers, Estes Park, Colo.

919,200. Sectional Cesspool. Dennis J. Menton and Henry Welchmann, Richmond Hill, N. Y.

924,664. Sewage Treatment Apparatus. Karl Imhoff, Bredeney, Germany.

Patents Concerning Sidewalks, Curbs and Gutters.

856,409. Concrete Sidewalk. Donald G. MacDonald, Detroit, Mich.

856,702. Concrete Gutter Machine. F. Howley, Pittsburg, Pa.

858,959. Guarder for Edges of Concrete Paving. Wm. Crenshaw, Atlanta, Ga.

861,655. Bracing for Sidewalks. Jacob Jacob, New York City.

861,686. Form for Making Concrete Curb or Gutters. Chas. E. Twitt, West Tampa, Fla.

864,069. Pavement Marker. Rudolph S. Blome and Wm. J. Sinek, Chicago, Ill.

864,276. Metal Nosing for Concrete Curb and Other Structures. Henry H. Wainwright, Philadelphia, Pa.

872,602. Form for Concrete Sidewalks. John R. and Adlow Zeiser, Berwick, Pa.

875,025. Curb Protector. Samuel Whinery, East Orange, N. J.

893,320. Edge Protector for Concrete. Eugene F. Glock, Detroit, Mich.

890,011. Reinforced Concrete (Sidewalk) Slab. Anton F. Anderson, Steger, Ill.

881,700. Reinforced Concrete Sidewalk. Francis J. Miller, Detroit, Mich.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Binghamton, N. Y.—Pavement repairs will begin in this city May 1.

Georgetown, Tex.—About four miles of cement sidewalks and street crossings have been constructed in this city during the last three months.

Bayonne, N. J.—A verdict for $237,-$32.08 was returned by a jury in the circuit court, April 11, in favor of William T. S. Crichfield and against this city, for money which Crichfield claimed was due him for repairing Broadway.

Salina, Kans.—Suit has been filed here April 2 by Haskins & Ramsey, a street paving company of Topeka, against the Kaw Valley Paving Company, of Topeka, and Mayor Charles B. Kirtland and the members of the city council of this city, asking for a restraining order to prevent the Kaw Valley Company and the city officials from proceeding with a paving contract made at the last meeting of the council. The plaintiff company asserts in its petition that its bid for the work was 20 cents a square yard less than the defendant company's bid. A temporary restraining order was granted and the case will be heard May 5.

CONTEMPLATED WORK.

Muncie, Ind.—Brick paving is contemplated for S. Council st.

Brazil, Ind.—Tarvia will be used on sundry streets this summer.

Hammond, Ind.—Plans have been prepared for paving an alley.

Winnetka, Ill.—Brick paving is contemplated for Railroad ave.

Knoxville, Ia.—Paving is contemplated for a number of streets.

Matthews, Ind.—Brick paving is contemplated at a cost of $17,328.

Gilman, Ill.—Plans are being prepared for 2,400 ft. of brick paving.

Bemidji, Minn.—Council contemplates paving the business district.

Ledyard, Ia.—The village council has condemned several sidewalks.

Reading, Pa.—Paving and repairing is contemplated for several streets.

Dunkirk, N. Y.—Council has voted to pave Swan st. from 3d to 7th sts.

Wadesboro, N. C.—This city voted to issue bonds for street improvements.

Davenport, Ia.—Plans have been prepared for paving an alley with brick.

Schenectady, N. Y.—Asphalt paving is contemplated for River road and Avenue A.

Olean, N. Y.—Brick paving is contemplated for three streets. Geo. J. Ball, cy. Engr.

Sedgwick, Kans.—Petitions have been filed for constructing 9 mls. of sand clay road.

Waterloo, Ia.—The city council has decided to grade, curb, gutter and pave W. 3d st.

Northfield, Minn.—The paving of W. 3d st. at a cost of $10,000 is contemplated.

Chariton, Ia.—Vitrified brick paving is contemplated for Grand st. and Auburn ave.

Marshalltown, Ia.—Objections will be heard May 20 (postponement of date), on the resolution to pave certain streets.

Pueblo, Colo.—The property owners have petitioned for about 40 blocks of streets in the central part of the city.

Pekin, Ill.—Cy. Engr. Van Deusin estimates the cost of paving 15,905 sq. yds. of S. 4th st. with brick at $27,162.93.

Glencoe, Ill.—Plans are being prepared for street improvements to include cement sidewalks, sewers, and water mains.

Hernando, Miss.—This city will issue $10,000 bonds for constructing cement sidewalks, the contracts to be let soon.

Selma, Ala.—This county will vote May 16 on the issue of bonds for constructing good roads in all sections of the county.

Williamson, W. Va.—(Special). Claude L. Gaujot, C. E., advices us that this city contemplates considerable street paving.

Des Moines, Ia.—Plans are being prepared by J. W. Budd, cy. engr., for paving 19th st. with concrete, and 26th st. with asphalt.

Moulton, Tex.—The property owners in Live Oak, the principal business street, are taking action toward paving that street.

Paxton, Ill.—Bids will be received on materials, about May 15, for about 1 mi. of tarvia macadam paving. C. F. Holman, cy. engr.

Paris, Ky.—Bourbon county contemplates expending an appropriation of $42,-000 on the turnpikes this year, in building and repairing road beds, and constructing new bridges and repairing old ones.

East Orange, N. J.—Asphalt block has been recommended as the material for repaving Main st. Joseph Lee, chm. road com. cy. coun.

Antigo, Wis.—B. W. Rynders, mayor, recommends resurfacing the present macadamized streets, macadamizing other streets, etc.

Houston, Tex.—Plans are being prepared for converting Buffalo bayou into a paved street, from Travis to Smith sts. Cy. Engr. Dormant.

Crookston, Minn.—The construction of 15 blocks of asphalt, 5 blocks of tar macadam, and 15 blocks of gravel paving is contemplated.

Sheboygan, Wis.—The city council passed an ordinance April 19, providing for paving 4 streets with brick and 6 streets with macadam.

Los Angeles, Cal.—An ordinance is pending ordering the Los Angeles-Pacific Company to pave portions of Sunset boulevard. Cy. Engr. Hamlin.

Buffalo, N. Y.—(Special). The budget for the expenses of this city during the next year contains $250,000 for the repair of asphalt pavements.

Mt. Vernon, Ill.—Vitrified brick paving is contemplated for 7th st. B. C. Wells, engr.

Marengo, Ia.—The construction of a model dirt road across the State is contemplated.

Centerville, Ia.—The construction of 2

mis. more of paved streets is contemplated.

Waukegan, Ill.—Paving is contemplated for County st., between Washington and Water sts.

Le Mars, Ia.—Concrete paving is contemplated in alleys running east and west in block 6.

Paulsboro, N. J.—Will vote June 7 on the issue of $7,000 street improvement bonds.

Penn Yan, N. Y.—This city voted, April 12, to pave Elm st., from Main to Kenke sts.

Excelsior Springs, Mo.—City council has passed a resolution for paving Kansas City ave.

Warsaw, Ind.—Resolutions have been introduced providing for paving about 3 mis. of streets.

Le Roy, N. Y.—The town board has set aside $6,649.74 for improving the highways this year.

Ft. Wayne, Ind.—Resolutions have been adopted for paving John st., Maumee ave. and certain alleys.

Dalton, Ga.—This city will vote May 14 on the issue of bonds for paving, water, lights, sewers, etc.

South Bend, Ind.—The city council decided, April 18, to pave Mill st., from Water st. to the Lake Shore tracks.

Marshalltown, Ia.—Council will take action May 11 on 17 blocks of concrete and 30 blocks of brick paving.

Marshalltown, Ia.—Plans are being prepared for 41,000 sq. yds. of brick paving. F. B. Wiley, cy. engr.

Watseka, Ill.—Plans are being prepared for paving 3rd and 5th sts. with macadam. G. C. Houston, cy. engr.

Marshalltown, Ia.—Plans are being prepared for 19,400 sq. yds. of concrete paving. W. Steiner, cy. engr.

Houston, Tex.—Shell and gravel will be used in improving about 72 mis. of new paved roads this year. Co. comrs.

Binghamton, N. Y.—A hearing will be held May 9 on the proposed brick paving in Court st., plans and specifications for which have been adopted.

Manchester, Ia.—Cement paving is proposed for Franklin st.

Albert Lea, Minn.—The construction of concrete curbs and paving in Pearl, College, Euclid and Washington sts. and Adams av. is contemplated.

Little Rock, Ark.—Petitions for paving Main st. with brick or creosoted wood blocks will be circulated soon.

Newark, N. J.—Ordinances have been passed for paving Ridge st. and 6th ave. with brick, and grading, curbing and flagging 3rd and Bloomfield aves.

Irvington, N. J.—The town council deferred action, April 19, on the petition to pave Avon ave., from Springfield ave. to the Newark city line.

Muscatine, Ia.—The farmers on Burlington road, below this city, are planning to construct a road and pave it with brick for a distance of 6 mis.

Arkansas City, Kans.—Petitions will be circulated among the farmers in Cowley county to construct about 14 mis. of road between this city and Winfield.

Darlington, S. C.—A petition is being circulated asking the city council to call an election to vote on the question of issuing bonds for street improvements.

Plymouth, Ind.—Eldridge Thompson, engineer, and Quincy Crane and John Berg, viewers, estimate the cost of macadamizing 4 mis. of the Michigan road at $31,107.06.

Morris, Ill.—Estimates of the proposed cost of paving are as follows: W. Jefferson st., $15,083.76; Jefferson st., from Wauponsee to Pinse sts., $9,340.73; Main st., $15,224.04.

Richmond, Ind.—The city engineer has been directed to prepare plans for paving N. 10th and S. 14th sts. with tarvia binder, and bids will be asked soon. Homer Hammond, chmn. B. P. W.

Indianapolis, Ind.—The cy. engr. is preparing plans for opening streets, constructing cement walks and curbs, permanent roadways, gravel roadways, resurfacing improved streets, etc.

Shawnee, Okla.—(Special.) Frank D. Browne, cy. engr., says resolutions have been passed for paving about 15 mis. of streets, at a cost of nearly a million dollars. F. D. Stearns, mayor.

Owensboro, Ky.—The fiscal court has granted permission to Jas. Thompson, of Louisville, president of the Glenmore Distillery Co., to build an asphalt road from the city limits to the distillery plant, on the Hardinburg road.

Mishawaka, Ind.—The city clerk has been directed to ask for bids for constructing grade, walks and curbing in W. 2nd and Elizabeth sts. A resolution has been passed to construct sidewalks and curbing in 10th and 11th sts.

Dallas, Tex.—Specifications have been adopted and bids will be asked for paving Elm st., between Market and Eway, with brick, bitulithic or bois d'arc blocks. Objections will be heard May 16 and 18 for the proposed paving of Highland st. and East Side ave., respectively.

Marshalltown, Ia.—The city council will leave May 2 on a paving inspection trip that will include Fond du Lac, Wis., and Minneapolis and St. Paul, Minn. Mayor Ingledue.

Buffalo, N. Y.—(Special). Plans are to be drawn by the commissioner of public work for paving Grant st. from Hampshire st. to Forest ave.; Ledger st. from Hertel ave. to Troost st.

Cincinnati, O.—New specifications are being made for street paving work, which will be examined by J. W. Howard, paving expert of New York City, who made a recent exposure regarding the paving specifications in this city, before the Associated Organizations of Business Men's Clubs.

Red Oak, Ia.—(Special). The city council will consider a resolution of necessity for 36,000 sq. yds. of bituminized macadam and 10,000 ft. of concrete curb, May 16. Thos. S. De Lay, of Creston, Ia., has been appointed engineer in charge and desires the addresses of manufacturers of manhole covers and other municipal castings.

CONTRACTS TO BE LET.

Rome, N. Y.—Bids are asked until May 4 for paving Stanwix st. and Floyd ave. B. P. W.

Goshen, Ind.—Bids are asked until May 2 for paving S. Main st. with brick. Mayor Spohn.

Versailles, Ind.—Bids are asked until May 3 for constructing 3 macadam roads. Nicholas Volz, co. audt.

Superior, Wis.—Bids are asked until May 5 for macadamizing Stinson ave. George E. Rolph, chm. B. P. W.

Westfield, N. J.—Bids are asked until May 16 for street improvements. Lloyd Thompson, town clk.

Cincinnati, O.—Bids are asked until May 13 for improving the Coney road. Fred Dreihs, clk. co. comrs.

Brownstown, Ind.—Bids are asked until May 3 for constructing a gravel road. H. W. Walker, co. audt.

Greencastle, Ind.—Bids are asked until

May 2 for constructing a gravel road. D. V. Moffett, co. audt.

Vincennes, Ind.—Bids are asked until May 3 for constructing gravel roads. John T. Scott, co. audt.

Huntington, Ind.—Bids are asked until May 3 for constructing a gravel road. Lemuel Colbert, co. audt.

Williamsport, Ind.—Bids are asked until May 6 for constructing a gravel road. Robt. L. Winks, co. audt.

Danville, Ind.—Bids are asked until 10 a. m., May 2, for constructing 2 roads. W. H. Nichols, co. audt.

Monticello, Ind.—Bids are asked until May 3 for constructing 4 gravel roads. John T. Scott, co. audt.

Brazil, Ind.—Bids are asked until May 6 for constructing 3 gravel roads. J. L. Burris, co. audt.

Logansport, Ind.—Bids are asked until May 3 for constructing a macadamized road. Geo. W. Cann, co. audt.

Valparaiso, Ind.—Bids are asked until May 3 for constructing macadam roads. Stephen P. Corboy, co. audt.

Long Beach, Cal.—Bids are asked until May 30 for paving Railway, American and Appleton sts. B. P. W.

Kentland, Ind.—Bids are asked until May 23 for constructing a system of macadam roads. E. R. Bingham, co. audt.

Wabash, Ind.—Bids are asked until May 3 for constructing gravel and macadamized roads. J. P. Noftzger, co. audt.

Kokomo, Ind.—Sealed bids are asked until May 3 for constructing gravel roads. A. B. Easterling, co. audt.

Crown Point, Ind.—Bids are asked until 12 m., May 2, for constructing 3 gravel roads. C. A. Johnson, co. audt.

Ft. Dodge, Ia.—Bids are asked until May 2 for constructing 54 blocks of asphalt paving. Cy. clk. Tany.

Buffalo, N. Y.—Bids are asked until May 4 for paving and repairing sundry streets. Francis G. Ward, comr. pub. wks.

Normal, Ill.—Bids are asked until May 5 for paving Main st. with brick on concrete base. J. H. Keys, cy. clk.

Indianapolis, Ind.—Bids are asked until May 6 for grading and graveling Eastern ave. C. A. Schroder, prest. B. P. W.

Madison, Ind.—Bids are asked until May 3 for constructing 6.64 mis. of gravel road. Gaylord F. Crozier, co. audt.

Bloomfield, Ind.—Bids are asked until May 3 for constructing a gravel and macadamized road. Peter M. Cook, co. audt.

Kentland, Ind.—Bids are asked until May 23 for constructing a system of macadam roads. E. R. Bingham, co. audt.

Marion, Ind.—Bids are asked until May 3 for paving a street in the town of Fairmount with brick. A. Y. Stout, co. audt.

Elyria, O.—Bids are asked until May 4 for improving the Chestnut Ridge and Cowley roads. J. T. Moon, chmn. co. comrs.

Hammond, Ind.—Bids are asked until May 16 for constructing cement sidewalks in Monroe st. Adam R. Ebert, chmn. B. P. W.

Dunkirk, N. Y.—Bids are asked until May 4 for grading and paving or macadamizing Swan and Fox sts. J. M. Sackett, cy. engr.

Bloomington, Ind.—Bids are asked until May 4 for constructing a pike. Horace Blakeley, co. audt.

Grand Forks, N. D.—Bids are asked until May 6 for grading and repairing about 4 mis. of county roads. Hans Anderson, co. audt.

Anderson, Ind.—Bids are asked until May 3 for grading and paving a public highway with brick. Wm. T. Richards, co. audt.

Cleveland, O.—Bids are asked until May 14 for paving Hurlbst road with Medina block stone. John F. Goldenbogen, clk. co. comrs.

South Bend, Ind.—Bids are asked until May 3 for paving St. Joseph, Navarre and Osborn sts. with asphalt. W. L. Mower, cy. engr.

Sullivan, Ind.—Bids are asked until May 4 for constructing a stone road. L. O. Turnbull, chmn. co. comrs; Ben C. Crowder, co. audt.

Columbus, O.—Bids are asked until May 10 for furnishing and placing crushed limestone screenings on Hess pike. H. K. Lindsey, co. surv.

Hammond, Ind.—Bids are asked until 10 a. m., May 2, for paving Lincoln ave. with macadam, with cement curbing. Adam R. Ebert, chmn. B. P. W.

Edwardsville, Ind.—Bids are asked until May 15 for constructing red granitoid sidewalks and brick paving in Clay st. Chas. A. Sheppard, cy. engr.

Peoria, Ill.—Bids are asked until May 9 for constructing 18,123 sq. yds. of brick paving in Garden st. Geo. F. Simmons, prest. bd. local impvts.

Jacksonville, Fla.—Sealed bids are asked until 3 p. m., May 2, for constructing sidewalks in 9 or more streets. P. A. Dignan, chmn. B. P. W.

Superior, Wis.—Bids are asked until 2 p. m., May 5, for constructing cement sidewalks in a number of streets. Geo. E. Rolph, chmn. B. P. W.

Abilene, Kans.—Bids are asked until May 10 for paving N. 1st st. with vitrified brick, bitulithic with concrete and crushed rock base, granitoid, etc.

Brookville, Ind.—Bids are asked until May 12 for constructing 2 mis. of public highway. John C. Huermann, chmn. co. comrs.; Chas. A. Miller, co. audt.

Jeffersonville, Ind.—Bids are asked until May 23 for constructing gravel roads in the counties of Clark, Scott and Jefferson. Peter Machaud, co. audt.

Elyria, O.—Bids are asked until May 4 for 7,000 sq. yds. sheet or asphalt block paving on concrete or macadam, with concrete or stone base. C. M. Theobald, cy. engr.

Salem, Ind.—Bids are asked until 1:30 p. m., May 2, for constructing Livona and Orleans road, 4,074 ft. in length. J. W. Elrod, prest. co. comrs.; G. Ellis, co. audt.

Wenatchee, Wash.—Bids are asked until May 3 for grading, curbing and paving with brick, creosoted wood block, asphalt or other suitable material. Sam R. Sumner, cy. clk.

South Bend, Ind.—Bids are asked until May 3 for paving E. Navarre st. with coal tar filled macadam or asphalt macadam. Otto C. Bostian, chmn. B. P. W.; Arthur D. Percy, cy. clk.

Janesville, Wis.—Bids are asked until May 10 for paving S. Main and Sinclair and S. 2nd sts. with brick, and S. 3rd st. with asphalt macadam. W. F. Carle, chmn. st. assmt. com.

Concord, N. H.—Bids are asked until May 6 for constructing roads, as follows: At Wilson, 6 mls. trap rock; at Winchester and Holderness, 3 mis. native stone. H. C. Hill, State engr.

Binghamton, N. Y.—Bids are asked until May 4 for paving Main st. with brick or creo-resinate wood blocks, Front st. with creo-resinate wood blocks, asphalt or brick, Washington st. with brick. Bd. contr. and sup.

Clinton, Okla.—Bids are asked until May 3 for constructing 67,000 sq. yds. asphalt paving on concrete base, 20,000

lin. ft. concrete curbing and gutter combined, 5,000 lin. ft. concrete curb, and 5,000 lin. ft. concrete gutter. C. G. Welch, mayor.

Vancouver, B. C.—Bids are asked until May 3 for paving Robson st. with wood block. Cy. clk.

La Grande, Ore.—Bids are asked until May 4 for constructing 43,920 sq. yds. of macadam paving. Cy. recdr.

Palatka, Fla.—Bids are asked until May 7 for constructing a hard surfaced road. S. Worden, secy. bd. trustees.

Davenport, Ia.—Sealed bids are asked until May 3 for paving Tremont av with Sarco mineral rubber, concrete curb, etc., and certain alleys with vitrified brick. Thos. Murray, chm. B. P. W.

Paterson, N. J.—Bids are asked until May 17 for 28,000 sq. yds. of asphalt, asphaltic macadam, Hassam, wood block and Medina block paving in Park ave.

Scranton, Pa.—Sealed bids are asked until May 24 for constructing an improved macadam road in three sections. Victor Burschel, chm. co. comrs; E. A. Jonse, controller; A. B. Dunning, road engr.

Longview, Ind.—Bids are asked until May 9 for constructing cement sidewalks in Wabash ave. with vitrified brick street and alley crossings. Harvey R. Tinsley, chm. bd. trustees town of Longview.

CONTRACTS AWARDED.

New Orleans, La.—Egans Bros. secured the contract for paving Palmyra st. for $80,275.

Los Angeles, Cal.—The contract for improving Whittier road was awarded to the Barber Asphalt Paving Co., for $99,-$15.63.

Duluth, Minn.—The contract for grading and graveling 6th st. was awarded to the Pastoret-Lawrence Co., for $52,024.50.

Lincoln, Neb.—The contract for paving 7th st. with Burlington brick was awarded to M. Ford, at $2.09½ a sq. yd.

Portland, Ore.—The Barber Asphalt Paving Co. was awarded the contract for paving Columbus st., at $1.44 a sq. yd.

Peoria, Ill.—A. D. Thompson was awarded a contract for paving S. Washington st., April 13, with brick, for $102,-000.

Ardmore, Okla.—The Shelby Downard Asphalt Co. was awarded the contract, April 6, for paving N. Washington st. with Ardmore rock asphalt, at $1.85 a sq. yd.

San Jose, Cal.—The contract for paving E. Santa Clara st. was awarded to the Ransome-Crummey Co., at 38½ cts. a sq. yd.

Baker City, Ore.—(Special). The Warren Construction Co. was awarded the contract for 21,190 sq. yds. of bitulithic paving.

Milwaukee, Wis.—The contract for building a 600-ft. extension to Lake Drive was awarded to Wm. Gillin, for $25,000.

Mankato, Minn.—The contract for paving 2nd and Main sts. with macadam was awarded to Fielding & Shepley, of St. Paul.

Cincinnati, O.—The Citizens' Road Preserving Co. was awarded the contract for oiling the streets at 4 15-16 cts. a sq. yd.

Spokane, Wash.—The R. S. Blome Co., of Chicago, was awarded the contract for paving Washington st. with granitoid, for $28,500.

Michigan City, Ind.—The contract for paving Hermitage ave. with Metropolitan brick was awarded to W. H. Bel & Co., for $6,500.

Ft. Worth, Tex.—(Special). The contract for constructing 17,500 sq. yds. of bitulithic paving was awarded to the Texas Bitulithic Co.

Rockville, Ind.—J. L. Harvey was awarded a contract for constructing the Perry Harmless gravel road in Jackson twp., for $3,737.

Harrisburg, Pa.—The contract for paving Granite st. was awarded to the Central Construction Co., at $1.53 a sq. yd.

Miami, Okla.—(Special). The contract for constructing 27,370 sq. yds. of bitulithic paving was awarded to Pardon S. Kaull.

Normal, Ill.—The contract for paving 5 streets was awarded, April 13, to Roy L. Williams, of Cairo, Ill., for $37,077.85.

Edmonton, Alta.—(Special). The Bitulithic & Contracting Co., Ltd., secured the contract for 23,000 sq. yds. of bitulithic paving.

Memphis, Tenn.—(Special). The contract for 20,000 sq. yds. of bitulithic pavement was awarded to the Southern Granite Co., of Nashville.

Jersey City, N. J.—The contract for paving the Newark turnpike with Amiesite was awarded to Wm. J. Coughlin, at $1.24 a sq. yd.

Spokane, Wash.—The contract for about 18 mis. of asphalt paving was awarded to J. F. Hill, of Chicago, for about $575,-000.

Albany, N. Y.—(Special). T. J. Mumm, 130 Best st., Buffalo, was awarded the contract for constructing gravel roads, for $50,000.

Naperville, Ill.—The contract for paving the residence streets was awarded to the John Hayes Sons Co., of Portland, Ind., for $65,000.

Minneapolis, Minn.—The contract for surfacing the Mound road at Lake Minnetonka was awarded to Jas. F. O'Neil, for $2,100.

Collins, Miss.—The contract for constructing 2,500 ft. of concrete sidewalks was awarded to the Guaranty Paving Co., of Jackson, Miss.

Grand Forks, N. D.—(Special). The Bitulithic & Contracting Co. Ltd. was awarded a contract for 20,000 sq. yds. of bitulithic paving.

Moline, Ill.—The Northwestern Construction Co., of Davenport, was awarded the contract for paving the bluff road with brick, for 25,110.

Topeka, Kan.—(Special). The contract for 11,905 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., of Kansas City, Mo.

Salina, Kas.—The contract for paving with asphalt concrete, on concrete base, was awarded to the Kaw Paving Co., of Topeka, at 1.75 a sq. yd.

Birmingham, Ala.—The contract for bitulithic paving in the 2nd and 3rd wards was awarded to the Southern Bitulithic Paving Co., for over $85,000.

Columbus, Ind.—The contract for constructing cement walks for the new city park was awarded to Harman Bros., of this city, at 6.4 cts. a sq. ft.

Ft. Worth, Tex.—The Metropolitan Construction Co. has been awarded a contract for about 2 mis. of mineral rubber paving in Lipscomb st., fo rabout $130,000.

Scranton, Pa.—The MacDonald Construction Co. secured the contract for paving Scranton and Jackson sts. and Bromley ave., with asphalt, at $1.75 a sq. yd.

Jamestown, N. Y.—The contract for 1,810 sq. yds. of bitulithic paving was awarded to Warren Bros. Co.

Perry, Ia.—The contract for 52,600 sq. yds. of bitulithic and creosoted wood block paving was awarded, April 19, to Wm. Horrabin, of Iowa City, for about $130,000.

Ellensburg, Wash.—The D. A. Williams Co., of Tacoma, submitted the lowest bid, April 13, for paving 3rd and Main sts. with brick, for $140,178.80.

St. Paul, Minn.—The contract for resurfacing Summit ave. with asphalt was awarded to the General Contracting Co., at $1.62 a sq. yd., or $53,940.20.

Aberdeen, S. D.—The contract for paving 2 mls. of streets with creosoted wood blocks was awarded to Flinn & Hanlin, of Sioux Falls, at $2.59 a sq. yd.

Portland, Ore.—(Special). The contract for 20,306 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., and for 1,807 sq. yds. to the Pacific Bridge Co.

Medford, Ore.—The contract for constructing 2,000,000 sq. yds. of asphalt paving, with curbing, was awarded to the Clark & Henry Construction Co., of Sacramento, Cal., for about $500,000.

Atlantic City, N. J.—The contract for 8,300 sq. yds. of bitulithic paving was awarded to the United Paving Co., and the contract for 6,700 sq. yds. of bitulithic paving was secured by E. L. Bader.

Pittsburg, Pa.—Contracts for paving were awarded, April 5, as follows: Coltart Square, Barber Asphalt Paving Co., $12,139; Hallock st., Opp Bros., $8,786; Labelle st., Thomas Cronin, $4,857.

Louisville, Ky.—Contracts were awarded, April 4, for vitrified brick paving, to the Staebler Co., G. W. Goswell and the Jefferson Construction Co., at prices ranging from $1.79 to $1.87 a sq. yd.

St. Joseph, Mo.—The Rackliffe & Gibson Construction Co. has been awarded a contract for paving Grand ave., for $20,-512, as follows: Hassam paving, 12,000 sq. yds.; curbing, 3,000 lin. ft.; sidewalk, 10,000 sq. ft.

Jonesboro, Ark.—The lowest bids for paving and sidewalks submitted April 17 were as follows: Vitrified brick paving, J. A. Kooms, of Mt. Vernon, Ill., $43,-580.10; sidewalks and curbing, Noah Bogard, of Washington, Ind., $13,006.25.

Elkhart, Ind.—The contract for paving 1 block of Boner st. with tarvia-macadam was awarded, April 13, to the Andrews Asphalt Paving Co., of Hamilton, O., at $1.06 a sq. yd. for macadam; 44 cts. a lin. ft. for curb and gutter; Total, $1,781.42.

Aberdeen, Wash.—The Barber Asphalt Paving Co. was awarded a contract for paving Market st., for $34,191.

The Dalles, Ore.—The Warren Construction Co. was awarded a contract for paving 3rd st., at $1.90 a sq. yd.

Seattle, Wash.—Paving contracts have been awarded as follows: Paving Montlake boulevard, P. J. McHugh, $23,156.48; W. Blaine st., et al., F. McClellan & Co., $67,556.77.

Houston, Tex.—Bids were submitted April 20 for paving 35½ miles of county roads, as follows: Webster air line road, 18 miles in length, running from a junction with the Harrisburg road south of Harrisburg to the Galveston county line, W. H. Hipp, $59,540; Suderman, Dolson Co., $61,542; Texas Grading Co., $67,-341; W. D. Haden, $69,460; M. C. Otto, $75,440. The specifications call for all shell material on this road. La Porte and Seabrook road, two and one-half miles in length, running from a connection with the La Porte shell road toward Seabrook, W. S. Hipp, $9,350; W. D. Haden, $10,-725; A. C. Workman, $11,310; Texas Grading Co., $11,549. Lynchburg and Crosby road, three miles in length, to be paved with clam shell and being extension of the present pavement, M. O. Otto, $16,-790; John Farmer, $17,875; Texas Grading Co., $19,110; R. V. Tompkins, $19,110. Main street road, to be paved with gravel and shell for a distance of eight miles from the terminus of present pavement, W. S. Hipp, $32,960; Texas Grading Co., $36,280; L. B. Davis, $37,295. Westheimer road to be paved with gravel and shell for a distance of four miles from the end of present pavement, Texas Grading Co., $16,876; L. B. Davis, $18,720; W. S. Hipp, $19,312.

Peoria, Ill.—The contract for 3,800 sq. yds. of brick paving and 1,900 ft. of curbing in Buena Vista ave. was awarded to Jansen & Zoeller, of this city, April 15, for $6,251. The Illinois Cement & Construction Co., of Springfield, secured the contract for paving an alley with brick, for $807.

Peoria, Ill.—John W. Bushnell has been awarded contracts for resurfacing streets with asphalt as follows: Seventh ave., $12,036.70; Hamilton st., two contracts, $8,201.10 and $3,354.20 respectively; N. Jefferson st., $28,802

Decatur, Ind.—Contracts for constructing four macadam roads have been awarded as follows: Hamlin st., grading, to S. Normile, at $11,350; 25th ave., North, grading, to S. Normile, $5,673; Melrose ave., North, paving, to Barber Asphalt Paving Co., $41,722; Nagle pl., asphalt paving, to Barber Asphalt Paving Co., $1,387; 12th ave., Northwest, grading, to J. T. Donaldson & Co., $10,465; Lafayette ave., grading, to N. D. Johnson, $14,040.

Dayton, O.—Bids were submitted April 4 for furnishing 8 carloads of asphalt for the city repair and construction work as follows: California Asphalt and Sales Agency, $28; Globe Asphalt Company, $32.50; the Warren Chemical Manufacturing Co., $28.60; the Barber Asphalt and Paving Company, $23.85; the American Asphalt and Rubber Company, $20.50.

Buffalo, N. Y.—Bids for paving four streets and an alley were submitted April 7 as follows: Linwood ave., asphalt, German Rock Co., $19,520; brick, L. H. Gipp, Constantine Construction Co., both at $16,500. Pine st., asphalt, Barber Co., 3,207; sandstone, F. V. E. Bardol, $5,900; brick, F. V. E. Bardol, $4,400. Abbey st., asphalt, German Rock Co., $19,920; brick, Constantine Construction Co., $16,000. Beacon st., asphalt, German Rock Co., $14,880; brick, Constantine Construction Co., $12,000. De Rutte alley, asphalt, German Rock Co., $1,166; brick, F. V. E. Bardol, $1,000; sandstone, F. V. E. Bardol, $1,250.

Louisville, Ky.—Contracts for reconstruction work have been awarded as follows: Barber Asphalt Paving Co., reconstructing Broadway, Walnut and Chestnut sts. and Barrett ave., $63,000; American Standard Asphalt Co., reconstructing Park and York sts., $6,600; S. L. Caxton Co., Richmond, Ind., asphalt reconstruction in 3rd ave., $32,000; American Standard Asphalt Co., original construction, Keats, Slaughter, Hillcrest and Grand aves., $32,000; L. R. Figg, original vitrified brick construction, Page and Walkins sts., $5,500; G. W. Gosnell Co., original vitrified brick construction, Preston court and Goss ave., $21,500.

Vicksburg, Miss.—Bids for paving Cherry st. were submitted, but the contract not let, April 18, as follows: Hot Spring Construction Co., brick, $86,919.06; wood block, $99,405.76; concrete, $79,-419.41; the Stevens Construction Co., brick, $90,494.85; asphalt, $88,603.95; concrete, $79,099.45; Barber Asphalt Co., $83,-915.35; Southern Bithulithic Co., $90,-380.65; Dunn & Lallande, brick, $89,-024.08; wood block, $105,429.08; South-

ern Paving & Construction Co., brick, $87,362,45; asphalt, $82,291.50.

Albany, N. Y.—Contracts for improving the public highways of state aid were awarded, April 5, as follows: Highway No. 683, Dryden-Cortland, Tompkins county, 3.57 miles; awarded to James McCormick, of East Providence, R. I., for 38.444; No. 801, East Rushford-Gordonville bridge, Allegany county, 4.68 miles; to Northwestern Construction Co., Franklin, Pa., $43,017; No. 787, East End, Otsego county, 0.47 miles; Charles E. Townsend, Oneonta, $5,700; No. 850, Canton-Corning, Steuben county, 6.15 miles; Northwestern Construction Co., Franklin, Pa., $61,263. No. 5,047, Watkins-Montour Falls, Schuyler county; McGuery, McGuigan & Baum Construction Co., Elmira, $23,043; No. 5,048, Lowman-Waverly, part 1, Chemung county; McGuery, McGuigan & Baum, Elmira, 35,310; No. 834, Kirkwood-River, Broome county; T. H. Gill Co., Boston, Mass., $75,676; No. 5,415, Deposit-Hales Eddy, Delaware county; Almahar Construction Co., Albany, $46,764; No. 5,046, Scottsville-Mumford, Monroe county; Monroe Roads Co., Pittsford, $57,906; No. 854, Castile Center-Perry Center, Wyoming county; Greece Construction Co., Rochester, $54,-925; No. 740, Sanborn-Pekin, Niagara county; Louis H. Gipp Co., Buffalo, $26,-950; No. 715, Dansville-Mount Morris, part 2, Livingston county; Northwestern Construction Co., Franklin, Pa., $55,792; No. 5,054, Eighteen-mile creek, Erie county; Frederick J. Mumm, Buffalo, 28,000; No. 857, Roberts road, Chautauqua county; county of Chautauqua, by W. L. Notally, $32,485; No. 852, Meridian village, Cayuga county; Alfred Gaffey, Syracuse, $11,-800; No. 664, Otselic-South Otselic, part 1, Chenango county; Joseph McCormack, East Providence, R. I., $43,188; No. 811, Georgetown-Otselic, Madison county; Joseph McCormack, $23,749; No. 5,041, Luna-East Bloomfield, part 2, Ontario county; Charles O. McComb, Syracuse, $34,500; No. 5,044, Mexico-Union Square, part 1, Oswego county; Cunningham & Woodward, Hudson Falls, $38,639.

Ft. Wayne, Ind.—Bids were submitted April 15 for paving as folows: The paving of Berry st., Barber asphalt Co., for Trinidad sheet asphalt, per lin. ft., $9.09; Moellering Construction Co., for Metropolitan block (brick), 6.45; for creosote block, $9.82; paving of Division st., Barber Asphalt Co., for Trinidad sheet asphalt, per lin. ft., $8.06; Derheimer & Sons, for Bessemer repressed brick, $8.29; Trippeer & Sons, for Bessemer or Metropolitan block, $8.22; Moellering Construction Co., for Metropolitan or other block, $8.31; Oscar Menefee, for Metropolitan block, $8.18; paving of Harner street, Derheimer & Sons, for Bessemer repressed block, per lin. ft., $6.85; Moellering Construction Co., for Metropolitan or other block, $7.13; paving of Pontiac st., Moellering Construction Co., for Metropolitan block paving, per sq. yd., $1.50; excavation per cu. yd., 45 cents; curb, per lin. ft., 60 cents; Derheimer & Sons, for Bessemer block, $1.56; excavations, 40 cents; curb, 50 cents; Tripper & Son, for Metropolitan or Bessemer block, 1.45; excavation, 40 cents; curb 55 cents. Ed Grosjean secured the contract for constructing cement sidewalks in High st. at 10⅝ cts. a sq. ft.

Macon, Ga.—Bids were submitted April 19 for paving the streets as follows: Georgia Engineering Co., granite block, 6-in. foundation, $2.08; 4-in. foundation, $2.57; 5in. foundation, $2.63; brick, 6-in., foundation, $2.08; 4-in., $1.93; 5-in., $2; wooden blocks, 6-in., $2.65; 4-in., $2.53; 5-in., $2.58; W. J. Beeland, Macon, granite block, 6-in., $2.71; 4-in., $2.60; 5-in., $2.49; wooden blocks, 6-in., $2.97; 4-in., $2.75; 5-in., $2.68; Barber Asphalt Co., asphalt, 6-in., $1.86; 4-in., $1.65; 5-in., $1.97; bitulithic, 6-in., $1.10; 4-in., $1.08; 5-in., $1.77; Atlantic Bitulithic Co., Richmond, Va., bitulithic, 6-in., $2.32; 4-in., $2.12; 5-in., $2.20; C. W. Lane Co., Atlanta, granite block, 6-in. foundation, $2.32; 4-in., $2.17; 5-in., $2.24; brick, 6-in., $1.94; 4-in., $1.79; 5-in., $1.86; wooden blocks, 6-in., $2.38; 4-in., $2.23; 5-in., $2.30; brick, with pitch filler, 8c per sq. yd., additional; Jamison & Hollowell; granite blocks, 6-in. foundation, $2.66; 4-in., $2.56; brick, 6-in., $2.23; 4-in., $2.05; 5-in., $2.12; wooden blocks, 6-in., $2.57; 4-in., $2.39; 5-in., $2.47; Hassam concrete, 6-in., $2.73; 4-in., $1.86; Hall-Parker Construction Co.: brick, 6-in. foundation, $2.23; 4-in., $2.03; 5-in., $2.13; wooden blocks. 6-in., $2.51; 4-in., $2.31; 5-in., $2.41; McPoland & O'Gara, Birmingham, Ala., wooden blocks, 6-in. foundation, $2.49; 4-in., $2.28; 5-in., $2.38; Rudolph S. Blome Co., Chicago, granitoid, 5-in. foundation, $2.04; W. M. Lasley, Chattanooga, granite blocks, 6-in. foundation, $2.28; 4-in., $2.12; brick, 6-in., $2.08; 4-in., $1.95; 5-in., $1.99; wooden blocks, 6-in., $2.29; 4-in., $2.12; 5-in., $2.21.

SEWERS.

CONTEMPLATED WORK.

Union City, Ind.—The sewerage system will be extended.

Ferndale, Wash.—A sewerage system is contemplated.

Sparta, Wis.—A sewer in Water st. is contemplated.

St. Paul, Neb.—This city voted to construct a sewerage system.

Miles, O.—Plans for constructing sewers are being prepared. B. P. S.

Madison, S. D.—This town may vote on installing a sewerage system.

Silver Lake, N. J.—A sewerage system is urged for this town.

Lebanon, Ind.—Plans for a sanitary sewer have been adopted.

South Haven, Mich.—Council has approved the construction of 4 new sewers.

Laurel, Mont.—This city to issue bonds for constructing a sewerage system.

Chehalis, Wash.—A sewer district is to be established here to cost $80,000.

Greenville, S. C.—This city voted to issue $40,000 bonds for sewer construction.

Canton, O.—A sewage disposal system will be installed here. J. A. Starret, cy. engr.

Princeton, Ill.—Surveys have been completed for a sewer system in the South End.

Irondale, Wash.—The construction of a temporary sewer in Moore st. is contemplated.

New Westminster, B. C.—Plans have been completed for constructing 20 mis. of sewers.

Corydon, Ia.—This city voted to issue bonds for the construction of a sewerage system.

Grand Haven, Mich.—Plans for constructing sewers in various streets have been accepted.

Whitefish, Mont.—This city voted to issue $10,000 bonds for constructing a sewerage system.

Texarkana, Ark.—A new sewerage district has been created in the northern part of this city.

Poteau, Okla.—This city voted to issue $40,000 for constructing a sewerage system. Mayor.

Missouri Valley, Ia.—Plans for a sewerage system have been completed, estimated cost $78,600.

Lowell, Mass.—The city council voted to obtain a loan of $50,000 for constructing sewers.

Providence, R. I.—An ordinance has been adopted providing for an issue of $400,000 sewer bonds.

Mishawaka, Ind.—A resolution has been passed to construct a sewer in Grove and E. Joseph sts.

Cincinnati, O.—An ordinance has been passed providing for the construction of a sewer in Elm ave.

Seneca, Kans.—Bids will be asked about June 1 for installing a sewerage system. C. H. Herold, cy. clk.

Warren, O.—Bids will be asked for soon for constructing a trunk sewer in White and Dickey run. B. P. S.

Columbus Junction, Ia.—The business men have been agitating the question of constructing a sewerage system.

North Tonawanda, N. Y.—Plans have been completed for a sewer system in the Rumbold ave. district of North Tonawanda.

Erwin, Tenn.—The construction of about 4 mis. of sanitary sewers is contemplated. Wm. Dunlap, engr., Johnson City, Tenn.

Beeville, Tex.—This city voted to issue $30,000 bonds for constructing a sewerage system, and a contract will be let soon.

Tacoma, Wash.—The citizens voted April 5 to issue $100,000 bonds for constructing 3 storm water sewers. W. C. Raleigh, cy. engr.

South Pasadena, Cal.—Plans for a sewerage system have been prepared by Olmstead & Gillillen, of Los Angeles.

North Amherst, O.—Plans for a sewerage system and disposal plant will be made by L. E. Chapin, of Canton.

Herington, Kans.—Plans are being prepared for installing a sewerage system. Burns & McDonnell, engrs., Kansas City, Mo.

Prairie du Chien, Wis.—Plans for a sewerage system will be made by W. G. Kirchoffer, of Madison. Eugene Amann, cy. clk.

Garnett, Kans.—Plans have been completed and bids will be asked for constructing a sewer. M. D. Pelkington, cy. clk.

Williamson, W. Va.—(Special). Claude L. Gaujot, engr., advises us that the extension of the sewerage system is contemplated.

Ada, O.—Plans will be prepared soon by Thos. Small, vil. engr., for installing a concrete sewer in this country. Elmer J. Carey, co. audt.

Indianapolis, Ind.—The question of constructing a sewage disposal plant will be considered this year.

Colfax, Ia.—Plans and specifications for 11,200 ft. of sewer will be made for this city by Engineer Watkins, of Iowa City.

Chicago, Ill.—A new drainage district has been created in the North Side along North Park ave. and a sewer will be constructed.

Houghton, Mich.—Plans for new sewers in 4 districts have been prepared by cy. engr. Crary, and objections will be heard May 4.

Ft. Wayne, Ind.—The construction of a main sewer and branches in Cottage and Beaver aves. is contemplated. F. M. Randall, cy. engr.

Columbus, Ind.—Council has ordered the construction of a new sewer to be known as the Maple Grove sewer, at a cost of about $29,000.

Newark, N. J.—Ordinances have been passed for constructing sewers in Frelinghuysen ave. Wm. E. Greathead, clk. bd. st. and water comrs.

Asheville, N. C.—Cy. Engr. Lee is preparing plans and specifications and will ask for bids for constructing a sewerage system in the East End.

Oroville, Cal.—Cy. Engr. Randall, of Sacramento, and Prof. Hyde, of the University of California, will supervise the construction of a sewerage system here.

Oshkosh, Wis.—Plans for constructing sewers in Durfee and other streets have been prepared. Sewers will also be built in 16th and other streets.

Brookfield, Ind.—(Special). Plans and specifications for a storm and sanitary sewer system are being made by John Finan. Bids will soon be asked.

Indianapolis, Ind.—New specifications for street and sewer improvement have been completed and bids for their construction will probably be asked about May 1.

Austin, Tex.—State health officer Brumby and Mark Hanner, sanitary engineer, visited San Antonio about April 15 to investigate sewerage system of that city.

Bellefontaine, O.—Plans have been completed and bids will be asked for about June 1 for constructing a sewerage system and disposal plant. C. A. Inskeep, cy. engr.

Ligonier, Pa.—(Special). Ira F. Brant, clk., advises us that F. H. Shaw, of Lancaster, Pa., has been engaged to prepare plans for a sewerage system and sewage disposal plant.

Roseville, Cal.—Plans and specifications have been submitted for constructing a modern sewerage system for the entire city, and the question of issuing bonds will be voted on.

Beloit, Wis.—Plans and surveys for a new sewer district in the northeast part of this city will be made by Geo. W. Sturtevant, of Chicago. A purification plant may also be erected.

Winnetka, Ill.—The construction of a sanitary sewer in the northwestern part of this city and storm sewers in sundry streets is contemplated. S. P. Greeley, prest. bd. local impvts.

Buffalo, N. Y.—(Special). Francis G. Ward, comr. pub. wks., has ordered plans prepared for constructing sewers in Argus st. between Roesch ave. and O'Neil st., west side of Franklin st., between Genesee st. and Chippewa st.

Belton, Tex.—The Belton Sanitary Sewerage Co. has been organized by Dr. J. M. Frazier, Rev. S. G. Townsend, C. B. Smith, C. F. Denny and J. W. Jarrell. A charter will be applied for and a sewerage system constructed.

Lenox, Mass.—Wm. S. Johnson, of Boston, has completed a report on sewers, and recommends an expenditure of $29,300 for 2 mis. of new sewers, extending the main sewer, constructing settling tanks, sludge beds, and filter beds.

Paterson, N. J.—A bill has been signed by Governor Fort, authorizing the Passaic Valley Sewerage Commission to contract with the U. S. government for the discharge of the Passaic Valley sewage into New York Bay at Robbins' Reef.

CONTRACTS TO BE LET.

Blaine, Wash.—Bids are asked until May 16 for constructing a sewer. Cy. clk.

Marion, Ind.—Bids are asked until May 7 for constructing Duckwell ditch. D. M. Murphy, supt. constr.

Mandan, N. D.—Bids are asked until May 9 for constructing a sewerage system. Lee Nichols, cy. audt.

Jackson, Tenn.—Bids are asked until May 3 for constructing sanitary sewers. Atwell Thompson, cy. engr.

Cumberland, B. C.—Bids are asked until May 4 for constructing certain sewerage works. Cy. clk.

Greenfield, Ind.—Bids are asked until May 4 for constructing a drain. V. A. Smith, drainage comr.

Wenatchee, Wash.—Bids are asked until 5 p. m., May 3, for constructing pipe sewers. S. R. Sumner, cy. clk.

South Bend, Ind.—Bids are asked until May 3 for constructing a pipe sewer in E. Broadway. A. P. Peerley, clk.

Bay City, Tex.—Bids are asked until May 10 for constructing drainage district No. 3. A. R. Leckie, engr. in charge.

Manhattan, Kan.—Bids are asked until 3 p. m., May 3, for constructing a complete sanitary sewerage system. A. W. Long, mayor.

Baltimore, Md.—Bids are asked until May 4 for constructing sec. 2 of the Jones Falls interceptor. C. W. Hendricks, ch. engr.

Perth Amboy, N. J.—Bids are asked until May 21 for constructing a 12 ft. sewer in Baker place. Geo. M. Adair, st. comr.

York, Pa.—Bids are asked until May 9 for constructing terra cotta sewer mains, flush tanks, manholes, etc. Harry Washers, chm. B. P. W.

Brainerd, Minn.—Bids are asked until May 11 for constructing lateral sewer "L" in sewer dist. No. 1. V. N. Roderick, cy. clk.

St. Paul, Minn.—Sealed bids are asked until May 18 for constructing state ditches. Samuel G. Iverson, state audt; Geo. A. Ralph, state drainage engr.

Westfield, N. J.—Bids are asked until May 16 for constructing 11,600 ft. 8 in. sanitary sewers, 21 manholes, 460 branches, 10 combined flush tanks, etc. Lloyd Thompson, town clk.

Belzoni, Miss.—Bids are asked until May 17 for constructing a system of house sewers 3 to 4 mis. of 8 and 10 in. pipe sewers, centrifugal pump and motor. Mayor and aldermen. Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

Davenport, Ia.—Bids are asked until May 3 for constructing sewers. Thos. Murray, cy. engr.

Paterson, N. J.—Sealed bids are asked until May 17 for constructing the Lake View sewer, including 2,660 ft. of 36 in., 1,140 ft. 30 in., 2,500 ft. 24 in., 1,400 ft. 18 in., 600 ft. 13 in., and 1,300 ft. 10 in. pipe and 6,800 ft. 6 in. house connections. H. J. Harder, cy. engr.

CONTRACTS AWARDED.

Everett, Wash.—Lower & Eckstrom secured a contract for a sewer in an alley for $1,876.

Indiana, Pa.—J. J. McGovern was awarded a contract for constructing the Normal school sewer.

Dallas, Tex.—C. W. Olcott secured a contract for constructing a sanitary sewer in Cochran st.

Oakland, Cal.—W. J. Schmidt was awarded a contract for sewer work in Broadway, for $1,605.75.

Hamburg, Ia.—The contract for constructing sewers was awarded to Dunnegan & Corey, of Shenandoah, for $8,180.52.

Ventnor, N. J.—The contract for constructing a large pipe sewer was awarded to Lemuel Henry, April 7, for $20,000.

Akron, O.—The contract for constructing the Bartges st. storm sewer was awarded to McAlonan Bros. for $8,254.

Hamburg, Ia.—The contract for constructing sewers was awarded to Dunnegan & Corey, of Shenandoah, for $8,181.

Dayton, O.—John Wise was awarded the contract for constructing a storm water sewer in Springfield st., for $3,254.80.

Eveleth, Minn.—The contract for installing a storm sewer was awarded to the Pastoret-Lawrence Co., Duluth, for $2,400.

Moline, Ill.—The Moline Heating and Construction Co. was awarded the contract for building a sewer in Eighteenth and-One-Half st., for 1,540.

Monroe, Wash.—The contract for instaling a sewerage system was awarded to the Evertt Construction Co., of Everett, Wash., for 12,689.

Galesburg, Ill.—Mart O'Connor was awarded a contract for constructing sewers in Kellogg, Cherry, 5th and Seminary sts., April 12, for 8,832.

Belton, Tex.—The Fountain-Shaw Engineering Co., of Dallas, was awarded a contract for constructing a system of sewers for the Belton Sanitary Sewer Co.

Palestine, Tex.—The contract for constructing 4 mis. of mains of mains for the Palestine Sewer Co. was awarded to Truehart & Jockson, of San Antonio.

Rochester, N. Y.—The contract for building a sewer in Dewey ave. and several adjacent streets has been awarded to Brayer & Albaugh, for $68,661.10.

Burlington, Wis.—The contract for constructing sanitary and storm sewers and water works extensions was awarded to Herman Hohensee, of Milwaukee.

Rock Island, Ill.—The contract for constructing sewer and water mains in Krells addition was awarded, April 18, to P. F. Trenkenschuh, for 3,420.

Tulsa, Okla.—H. C. Cass & Co. was awarded the contract for constructing 1,166 ft. of combination storm and sanitary sewer in W. 1st st., for $13,268.

Abilene, Kans.—The contract for constructing a storm sewer in Chestnut and S. 1st sts. was awarded to contracting engineer Underwood, of Houston, for $14,-831.72.

Michigan City, Ind.—H. W. Bell was awarded a contract for constructing the Wilard ave. district sewer, for $39,833, and for the Tryon district sewer, for $5,668.

Ada, Okla.—The contract for constructing 10,150 lin. ft. of sanitary lateral sewers in district 3 with appurtenances, was awarded to Gilkerson & Lecy, of Muskogee, for $8,128.

San Francisco, Cal.—The Healy-Tibbits Constr. Co. was awarded a contract for constructing the Yerba Buena sewer, which is to provide an outlet for the sewage in the district bounded by Market, 2d Howard and East sts., for $211,000.

Peabody, Kans.—(Special). J. W. Mavity, cons. engr., Lyndon, Kans., advises us that the contract for constructing 4 mis. of main and lateral sewers and 1 reinforced septic tank in this city, was awarded April 15 to Marshall Bros., of Los Animas, Colo., for $17,066.59.

Logan, Ia.—The contract for constructing sections 1, 2 and 3 of the Upper Bayer river drainage district was awarded to the Canal Construction Co., of Chicago, at 6 8-10 cts. a cu. yd. J. B. Norris, of

Logan, secured the contract for section 4, consisting of the removal of the dam and other stream obstructions.

Columbia, Wis.—Bids for constructing tile and earthenware sewers was awarded April 5 as follows: To Columbia Paving Co. for sewers 30, 31 and 33, $14,039, and to C. A. Stewart for sewer 28 at $4,261.

Minneapolis, Minn.—Bids for furnishing this city with sewer pipe were submitted as follows: Red Wing (Minn.) Sewer Co., $62,779; Blackmar & Post Co., St. Louis, $64,552; Evans & Howard, St. Louis, $66,198.

Louisville, Ky.—Bids were submitted April 15 and taken under advisement, for constructing sewerage systems in 15th and 23d sts., as follows: Henry Bickel Company, L. W. Hancock Company, of Louisville; Gyld & Co., Chattanooga; James Ferry Company, Pittsburg, and the B. C. Miller Sons Company, of Louisville.

Richmond, Va.—Contracts for constructing sewers have been awarded as follows: Burton & Driscoll, sewer in West st. and other streets, $18,948; West Cary st., $8,428; Shepherd st, $14,371; West st., $8,426; J. C. Cheatwood, sewer in North 17th st., $6,986; I. J. Smith & Co., sewer in West Cary st., $7,717, all of Richmond.

Lawrence, Kans.—Sewer contracts have been awarded as follows: Richard Keys has been awarded contract at $1.50 per lin. ft., and 40 cts. for excavation, for the construction of a storm sewer of brick in Henry st., between Maine and Missouri sts; and Graeber Bros., at $3.75 per lin. ftfl and 25 cts. per cu- yd. for excavation for the construction of a concrete culvert in Mississippi st.

WATER WORKS.

Holland, Tex.—The Holland Water Co. has been organized and will sink an artesian well.

Humble, Tex.—The Humble Water, Light and Ice Co. has been incorporated by W. E. Sholar, C. L. Polk and E. L. Cullum.

Ardmore, Okla.—The bd. of city comrs. has instituted proceedings to condemn a tract of 160 acres in Murray county, 12 miles east of the Washita river, as a site for a water power plant.

Brownstown, Ind.—The Browntown Water and Light Co. has been incorporated to supply town, communities, etc., with water, heat, light and power, by Harley Jackson, . B. Vance, and Geo. S. Grary.

Plainfield, N. J.—The citizens voted to give common council the power to purchase by condemnation the water plant of this city, to erect a new plant, or make another contract with the Union Water Company, a private corporation.

CONTEMPLATED WORK.

Winfield, Ia.—A water works system is urged.

Plymouth, Ind.—Council has passed a water meter ordinance.

Connersville, Ind.—This city will drill a test water well.

Carson, Ia.—Will vote on the issue of bonds for a water works system.

Alma, Wis.—This town voted to construct a water works system.

Lewiston, Utah.—The construction of a water works system is contemplated.

Le Beau, S. D.—Will vote on installing a water works system.

Manchester, Ia.—This city may adopt a new water meter system.

Kennett, Mo.—This city voted to construct a water works system.

Snyder, Tex.—This city voted to issue $17,400 water works bonds.

El Reno, Okla.—Voted to issue bonds for constructing water works.

Redwood Falls, Minn.—Council has decided to construct a 4 in. main on 3d st.

Willard, Utah.—This city voted to issue $9,000 bonds for water works purposes.

Elkhart, Ind.—Means are being devised here for obtaining a better water supply.

Corydon, Ia.—This city voted to issue bonds for constructing a water works system.

Newport, Tenn.—The question of municipal water works for this town is being urged.

Gardner, Mass.—The extension of the water mains in West st., 1,000 ft. is contemplated.

South Bend, Ind.—The construction of a large number of water mains has been authorized.

Montclair, N. J.—A proposition is being discussed for establishing a municipal water plant.

Raymond, Minn.—Will vote on the issue of bonds for constructing of water works system.

Waterloo, Wis.—Voted to issue bonds for installing a municipal water works system.

Gainesvile, Ga.—This city coted to issue $100,000 bonds for the construction of water works.

Youngstown, O.—The establishment of a reservoir for a municipal water supply is contemplated.

Minneapolis, Minn.—The council water com. has ordered the construction of water mains in 25 streets.

Churchville, N. Y.—The business men are agitating the question of constructing a water works system.

Pueblo, Colo.—A committee of 25 has been appointed to investigate the proposed improvement of the water supply.

Osyka, Miss.—The construction of a water works system is contemplated and bids will probably be asked in June or July.

Saginaw, Mich.—The board of water comrs. has approved the proposed construction of new water mains this year.

Hartsell, Ala.—The installation of a water works and electric light plant is contemplated. J. H. Corsbie, mayor.

New Britain, Conn.—The board of water comrs. voted to build a reservoir on the Pierre property. Estimated cost, $20,000.

Croghan, N. Y.—A bill has been passed authorizing the village trustees to issue $29,000 bonds for constructing water works.

Pipestone, Minn.—The citizens of the independent school district voted to construct a complete water works system.

Mt. Jackson, Va.—This city voted to issue bonds for constructing a gravity system of water words. F. E. Brill is interested.

Ligonier, Pa.—(Special). Plans for enlarging the municipal water works system are being prepared by Ira F. Brant, clk.

Vicksburg, Miss.—City council is considering the purchase of the present water works system instead of constructing a system.

Grand Rapids, Mich.—This city voted April 4 to construct a filtration plant, and extend the water mains. Jas. Schriver, cy. clk.

Williston, N. D.—This city has under consideration the substitution of a system of wells instead of a settling basin at the power plant.

Pittsfield, Mass.—The water com. recommends the construction of a reservoir

on the headwaters of Mill Brook. Estimated cost, $250,000.

Niagara Falls, N. Y.—The water comrs. have decided to ask for bids for constructing a filtration plant for the new water works system.

Jackson, O.—(Special). E. C. McConnell may desire to purchase 1 hoist, 1 trenching machine, water pipe, and pumps for the water plant.

Canandaigua, N. Y.—The pumping system of this city is inadequate, and an investigation is being made with a view to installing a duplicate system.

Port Angeles, Wash.—The Port Angeles Water Supply Co. has been organized by by W. W. Seymour and associates for the purpose of constructing a new water works system.

Indianapolis, Ind.—The board of public works will, in the future, order only 400,000 ft. of mains a year, the amount the Indianapolis Water Co. is required to lay under its contract with the city.

Williamson, W. Va.—(Special). Claude L. Gaujot, cons. engr., says this city contemplates installing a purification plant for the water works system. Address all communications to Claude L. Gaujot, engr.

Harrisburg, Pa.—The state water supply comrs. held a hearing April 19, on the application of the board of public works of this city to erect a low dam across the Susquehanna river at the lower end of the city.

Dayton, O.—A special committee has been appointed to investigate the water question, ascertain the various sources of supply, and what the city is doing to secure the proper permanent supply. The members of the committee are Chas. Thomas, F. C. Marley and C. A. Brooks.

CONTRACTS TO BE LET.

Colby, Kans.—Bids are asked until May 3 for constructing a water and electric light system. C. V. Parrott, cy. clk.

Leslie, Md.—Bids are asked until June 1 for constructing a clay lined reservoir, furnishing c. i. pipe, etc. G. A. M. Johnson.

Waterbury, Conn.—Bids are asked until May 20 for constructing a concrete dam in the town of Morris. R. A. Cairs, cy. Engr.

Cherokee, Ia.—Bids are asked until 8 p. m., May 3, for constructing 1,000 ft. 6 in. c. i. water pipe and 2,200 ft. 4 in. c. i. water pipe.

Meridian, Miss.—Bids are asked until May 31 (readv.), for constructing 8,500 ft. 24 in. reinforced concrete conduit. Wm. F. Wilcox, genl. engr., water comn.

Detroit, Mich.—Bids are asked until June 14 for erecting an engine room building superstructure at the new pumping station. Benj. F. Ginney, secy. bd. water comrs.

Johnson City, Tenn.—Bids are asked until May 5 for constructing a water supply system, including 12 miles of 18 in. gravity mains and a reinforced concrete reservoir.

Atlantic City, N. J.—Bids are asked until May 3 for installing a generator, exciter, switchboards and transformers at the Abrecon pumping station. Louis Knehule, prest. water bd.

Creede, Colo.—Bids are asked until May 25 for constructing a dam and spillway at the Rio Grande reservoir site, 30 miles west of here. San Luis Valley Irrigation Dist., Center, Colo.

Breaux Bridge, La.—Bids are asked until May 3 for constructing 2,200 ft. 8 in. and 12,400 ft. 6 in. c. i. water main; 25 fire hydrants, valves, pumps, tank and tower, etc. John Comeau, cy. clk.

CONTRACTS AWARDED.

Brainerd, Minn.—The contract for installing a pump was awarded to Slipp-Greuenhagen Co., for $885.

Austin, Tex.—The contract for rebuilding the dam was awarded to the Dumont-Holmes Steel Concrete Co., of Chicago.

Colton, S. D.—J. L. White, of Sioux Falls, submitted the lowest bid for installing a water works system, at $5,985.

Ardmore, Okla.—The contract for constructing a filtration plant has been awarded to Geo. Erickson of this city, for $10,437.

Tacoma, Wash.—D. A. Williams & Co. was awarded the contract for constructing a water main district in the west end for $23,950.

Lebanon, Pa.—The concrete for constructing the new water distributing system was awarded to W. M. Chishold & Son, of Pittsburg.

Gilbert, Minn.—The contract for the extension of the water works system was awarded to Postoret & Lawrence, of Duluth, for about $11,400.

Duluth, Minn.—Contracts were awarded April 18 for constructing nearly 3½ miles of water and gas mains, at a cost of about $32,000.

Buffalo, N. Y.—(Special). The contract for installing 5 pumps in the new pumping station was awarded to the Holly Mfg. Co., for $674,769.

Bradford, Pa.—The contract for constructing a reservoir in Bradford was awarded to Wm. McIntire & Sons, of Sharon, Pa., for about $100,000.

Oakesdale, Wash.—The contract for furnishing the material for the water works system to be installed here was awarded to Crane & Co., of Spokane.

Houston, Tex.—A contract for furnishing 500 standard sapphire meters in assorted sizes has been awarded to the Standard Water Meter Co., of Brooklyn.

Winnipeg, Man.—The Canadian Fairbanks Co. was awarded the contract for furnishing hydrants at $37 each, and T. McAvity & Sons the contract for supplying valves.

South Bend, Ind.—The Glamorgan Pipe and Foundry Co., of Lynchburg, Va., was awarded the contract for furnishing 300 tons of pipe and special castings, at $25.50 per ton for pipe and $49 per ton for special castings.

Ogden, Utah.—The contract for constructing reservoir No. 2 was awarded to the Wheel Wright Construction Co., of this city, as follows: 2,050 cu. yds. concrete including forms, $7.24; 200 cu. yds. excavation, 50 cts.

Krebs, Okla.—The contract for constructing a dam in connection with the water works system was awarded to Lane & Williamson, for $16,000, and F. C. Broks & Sons Co., of Jackson, Mich., received the contract for constructing water pipe, furnishing hydrants, etc., for $21,408.

Buffalo, N. Y.—(Special). The contract for furnishing 8 750 H. P. water tube boilers for the new Porter ave. pumping station was awarded to Farrar & Trefts, for $185,000. The Monarch Engineering Co. secured the contract for coal and ash-handling equipment for 34,875.

Portales, N. M.—The contract for 2 generators to be installed in connection with the work of the Portales Irrigation Co., Portales, was awarded to the Westinghouse Electric Mfg. Co., of Pittsburg, Pa. The contract for construction work was awarded to the Western Construction Co., of Wichita, Kans., for about $350,000.

Lancaster, Pa.—Contracts were awarded April 18 for water meters to the Na-

tional Meter Co., of New York; Pittsburg Meter Co., East Pittsburg; Thomas Meter Co., Brooklyn; Neptune Meter Co., New York City; H. R. Worthington, Philadelphia. Other contracts awarded were as follows: Furnishing pipe, U. S. Cast Iron Pipe and Foundry Co., Williamsport; lead, R. W. Cummings & Co.; specials, Barry & Zecher; ferrules, H. Mueller Co., N. Y. City; excavating and hauling pipe, W. J. Hinden.

St. Louis, Mo.—Bids for water extension contracts were submitted April 19 as follows: Water pipe, Dimmick Pipe Co., $52,437; special castings, Bessemer Foundry and Machinery Co., $12,428; stop valves, Roe Stephens Manufacturing Co., $4,995; fire plugs, American Foundry Co., $17,825; laying water pipe, John O'Donnell, $8,040. The pipe laying contract includes 43,000 feet of six-inch pipe, 15,000 feet of twelve-inch main, 4,700 feet of twenty-inch pipe, the installation of 158 fire plugs, and taking up of 4,800 feet of six-inch main.

BRIDGES.

Stevenson, Wash.—Bids are asked until July 5 for constructing 2 bridges. County comrs.

Peru, Ind.—Bids are asked until May 5 for constructing 20 bridges. Chas Griswold, co. audt.

Danville, Ind.—Bids are asked until May 17 for constructing 10 bridges. W. H. Nichols, co. audt.

Jamestown, N. Y.—(Special). This city voted to construct 2 concrete brilges at a cost of $50,000.

Cedar Rapids, Ia.—Bids are asked until May 7 for erecting a new concrete steel bridge. Cy. coun.

Shreveport, La.—A wagon bridge across Red river between this city and Bossier, is contemplated.

Bungo, Minn.—Bids are asked until May 7 for constructing a pile bridge on Bungo creek. W. N. Hanley, chm. town bd.

Pendleton, Ore.—Bids are asked until May 6 for constructing 2 steel bridges. Frank Saling, co. clk.

Monticello, Ind.—Bids are asked until May 3 for constructing 3 sets of stone abutments. Chas. A. Gay, chm. co. comrs.; A. G. Fisher, co. audt.

Petersburg, Ind.—Bids are asked until May 3 for constructing 5 steel bridges. F. R. Bilderback, co. audt.

Salamanca, N. Y.—Plans are being prepared for a reinforced concrete or steel bridge. Fred Gardner, town clk.

Kokomo, Ind.—Bids are asked until June 7 for constructing a bridge across Wild Cat creek in Center township. Co. comrs.

Mt. Morris, N. Y.—The culvert over the power race on State st. is to be rebuilt. Jas. E. Kelly, resident engr.

Ypsilanti, Mich.—Bids are asked until May 16 for constructing a reinforced concrete bridge over Huron river. S. Damon, cy. clk.

Eugene, Ore.—Bids are asked until May 9 for constructing a wooden bridge over the Row river 2 mls. east of Cottage Grove.

Jacksonville, Ore.—Bids are asked until May 5 for constructing a steel bridge across Bear Creek at Phoenix, Ore., co. clk.

Linton, N. D.—Bids are asked until May 10 for constructing concrete abutments for the Petrle bridge. J. C. Pitts, co. audt.

Pittsburg, Pa.—Bids are asked until May 3 for constructing superstructure and masonry of bridge No. 1, Thompson's Run, Turtle Creek borough. R. J. Cunningham, co. contr.

Elkins, W. Va.—Bids are asked until May 6 for constructing a bridge across Cheat river. E. A. Rowan, clk of court.

Greensburg, Ind.—Bids are asked until May 14 for constructing a concrete bridge in Jackson township. John G. Evans, township trustee.

Crown Point, Ind.—Bids are asked until June 6 for constructing a concrete bridge and a steel bridge. Chas. A. Johnston, co. Audt.

Coquille, Ore.—Bids are asked until May 5 for constructing a bridge across the South Fork of the Coquille river at Herman Place. Co. clk.

Cleveland, O.—Bids are asked until May 11 for constructing a concrete culvert and conduit and a concrete bridge. John F. Goldenbogen, co. clk.

Gretna, La.—Bids are asked until June 1 for constructing a steel bridge over a canal in Jefferson Parish. E. M. Hubert, secy. police jury.

Cincinnati, O.—Bids are asked until May 6 for constructing a concrete culvert on zig zag road. Stanley Struble, prest. co. comrs.

Cheboygan, Mich.—Bids are asked until May 10 for constructing a railway bridge across the Cheboygan river. Detroit & Mackinac Ry. Co.

Wabash, Ind.—Bids are asked until May 3 for constructing a steel, a concrete bridge, arches, and bridge repairs. Blondell Perry, co. engr.

Princeton, Ind.—Bids are asked until May 4 for constructing 11 steel bridges and 14 reinforced concrete bridges. W. T. Roberts, co. audt.

Cohasset, Minn.—Bids are asked until May 3 for constructing a steel bridge with concrete abutments over the Mississippi river. E. W. Windsor, town clk.

Minneapolis, Minn.—The Security Bridge Co., was awarded a contract for constructing a bridge at Lake st. and 2 bridges at Lake of the Isles, for $80,000.

White Rocks, Utah.—Bids are asked until June 1 for constructing the substructure of a steel bridge at Uintah and Ouray Indian agency. Comr. Indian Affairs, Washington, D. C.

STREET LIGHTING.

Hempstead, Tex.—An electric light plant is contemplated.

Horse Cave, Ky.—An electric light plant is contemplated.

Miles City, Mont.—Voted to construct a municipal electric light plant.

Troy, Kans.—Voted to issue bonds for constructing an electric light plant.

Hartselle, Ala.—An electric light plant is contemplated. J. H. Corsbie, mayor.

Manti, Utah.—This city voted to issue $25,000 bonds to construct an electric light plant.

Severy, Kans.—Will vote May 10 on the issue of bonds for building a municipal electric light plant.

Colby, Kans.—Bids are asked until May 3 for constructing an electric light plant. Fred A. Werth, mayor.

Crawfordsville, Ind.—This city will vote May 17 on the construction of a new electric light and power plant.

Lebanon, Mo.—Voted to issue $20,000 bonds for improvements to the electric light plant. T. B. Bailey, cy. clk.

Ft. Logan H. Roots, Ark.—Bids are

asked until May 10 for constructing an electric light system here. Constr. Q. M.

Hoboken, N. J.—The Citizens' Light, Heat and Power Co. has asked for a franchise for lighting this city with electricity.

Hempstead, Tex.—An electric company has been organized to install an electric light plant. J. D. Harvey, prest.; J. C. Amsler, secy.

Newark, N. J.—An extension of the city hall lighting plant so as to supply electric light to municipal buildings near the city hall has been recommended.

Connersville, Ind.—The Connersville Light, Heat and Power Co. is preparing to ask for bids for enlarging and remodeling the plant.

Racine, Wis.—The question of improving the illumination of the streets of this city is being discussed. Mayor Horlick, Cy. Engr. Connolly.

Lockport, N. Y.—C. E. Dickinson heads a syndicate that bought out the Hydraulic Raceway Co. and will form a new company to bid for the lighting contract in this city.

Baltimore, Md.—Bids are asked until May 11 for furnishing and erecting electrical and mechanical equipment for the sewerage works. C. W. Hendricks, ch. engr. sewer comn.

Ft. Giebler, R. I.—Bids are asked until May 11 for the extension and remodeling of an underground electrical distributing system here. Lieut. Frank H. Phipps, Jr., constr. Q. M.

Laporte, Ind.—Julius A. Barner, A. L. Boyd, and J. J. Kreidler were appointed a committee by Mayor Darrow to consider the installation of boulevard lights in the down town districts.

Avon, N. Y.—A syndicate has purchased the entire capital stock of the Livonia Light and Heat Co., and will build a transmission line from there to this city and furnish electricity to both places.

New York City.—(Special). The Elmer P. Morris Company, manufacturers of lamps, posts and lighting specialties for exterior work, are erecting a factory at Elizabethtown, Pa. Upon its completion their present factory at Newark, N. J., is to be closed down. Although the new factory has a capacity of several times that of the old one, it will take several months to complete orders on hand.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Mankato, Minn.—Council contemplates the purchase of a sprinkling cart.

Paterson, N. J.—The question of cleaner streets is being agitated. Mayor McBride.

Corning, N. Y.—The construction of an incinerating plant is contemplated.

Rushville, Ind.—The advisability of oiling the paved streets is under consideration.

New Castle, Ind.—The business men and citizens have petitioned for the sprinkling of the streets.

Irvington, N. J.—The ordinance providing for the sprinkling of the streets with oil was laid over until May 3.

Oreton, Wis.—Bids are asked until May 5 for sprinkling the village streets. G. L. Boots, vil. clk.

Topeka, Kans.—The contract for constructing a crematory was awarded to Lewis & Kitchen, of Kansas City, Mo., for $16,700.

Vancouver, B. C.—Bids are asked until May 31 for installing a garbage destructor plant at Bridge at. W. McQueen, cy. clk.

Geneva, N. Y.—The contract for sprinkling and flushing the streets was awarded to Walter Curtis, at $115 a week for 30 weeks.

Newark, N. J.—The board of trade recommends that the streets be placed under the care of single commissioner, as one means of securing cleaner streets.

San Francisco, Cal.—The business men and residents of Kentucky st. are agitating the question of establishing a street sweeping and sprinkling service.

Boston, Mass.—Bids are asked until May 15 for furnishing watering carts and watering and oiling streets in 10 districts, and for cleaning streets and sidewalks in 4 districts. G. C. Emerson, supt. sts.

Washington, D. C.—Contracts were awarded April 7 for the collection and disposal of garbage, as follows. Collection and disposal of garbage, 5-year contract, to Washington Fertilizer Co., Washington, D. C., at $68,400 per year; collection and disposal of dead animals, 5-year contract, to Robt. E. Mann, Four Mile Run, Va., at $2,855 per year; collection and disposal of night-soil, 3-year contract, to Warner Stutler, Washington, at $16,600 per year; collection and disposal of miscellaneous refuse, weekly, 5-year contract, to Michael R. Ready, Washington, at $17,000 per year; collection and disposal of ashes, 5-year contract, to James W. Bean, Washington, at $73,150 per year; collection and disposal of ashes and refuse from buildings under control of the District Commissioners, 3-year contract, to Warner Stutler, Washington, at 40 cts. per cu. yd.

PARKS.

Bay City, Tex.—A 6-acre park tract adjoining the city limits is contemplated.

Memphis, Tenn.—The city park commissioners are working out plans for making the park system unsurpassed.

Glen Ridge, N. J.—Council passed a resolution to transfer Glen Park to the Essex County Park Commission.

Milwaukee, Wis.—The park commission will expend $8,000 on the improvement of the city's parks this year.

Pittsburg, Pa.—The civic commission has appointed Bion J. Arnold, of Chicago, John R. Freeman, of Providence, and Frederick Law Olmstead, of Boston, to plan extensive improvements to the park system here.

FIRE APPARATUS.

Sandpoint, Idaho.—Will vote June 7 on the issue of bonds for a fire alarm system.

Inkster, N. D.—The purchase of 2 chemical engines is contemplated at a cost of $700.

Beaumont, Tex.—The question of installing a fire alarm system is being considered.

Hackettstown, N. J.—The contract for furnishing 500 ft. of fire hose was awarded to the Voorhees Rubber Mfg. Co., of Jersey City, at 90 cts. a ft.

Portland, Ore.—Bids are asked until May 31 for furnishing 5 third-size fire engines, 1 second hand fire engine and 2 combination chemical and hose wagons. Cy. audt.

Madison, N. J.—Bids for furnishing an auto-chemical fire engine were submitted April 11, as follows: Webb Motor Co., 1,000 ft. hose and hand extinguishers, $7,500; America-La France Co., machine, $6,500.

MUNICIPAL ENGINEERING

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TOWN SCAVENGING AND REFUSE DISPOSAL.

UTILIZATION OF HEAT FROM REFUSE DESTRUCTION.

By Hugh S. Watson, A. M. I. C. E., London, England.

THE Utilization of Heat Generated by Refuse Destructors by Its Conversion Into Energy. It has already been stated that the best uses to which the steam generated by destructors can be put are the pumping of a town's water or sewage, or for electric lighting or traction, as for these purposes the power will be required almost continuously throughout the whole twenty-four hours. At many works throughout England the steam generated is being used with good results for one or other of these purposes, and in order to show the saving which can be effected by its use, the author proposes to give a general description of the results obtained at some of the larger towns and Metropolitan boroughs.

In the city of Liverpool about 600 tons of refuse are dealt with per day. The steam generated is employed in the Corporation's power house in connection with the electric tramway undertaking. Between thirty and forty cars are sent over 100 miles of track each day solely by means of power derived from the steam generated by the destructors. Mr. Brodie, the city engineer, estimates that every ton of refuse delivered into the destructors is worth about one shilling and two pence for steam raising purposes.

At Rotherham a part of the heat generated by the burning of the refuse is utilized to raise steam for driving an air compressor which is used to work the ejectors employed to raise the sewage from certain low lying parts of the town. The remainder of the steam is passed to the electricity generating station. In many places clinker crushing machinery, and brick and slab making plants are driven entirely by the steam generated by the burning of the refuse, and in some instances the waste steam after it has been used for these purposes is still further employed in connection with steam disinfectors. There are many makes of these upon the market, but perhaps the best known are those of Messrs. Goddard, Massey & Warner, Ltd., and Messrs. Manlove, Alliott & Co., Ltd. The principle is the same in both designs, and consists of the introduction of steam under regulated pressure into a specially constructed aparatus. The machines are used for disinfecting the clothing and bedding, etc., of people who have been suffering from infectious diseases.

At Cambridge the whole of the town's sewage is pumped by means of steam generated at the destructors, which comprise six cells working in connection with three Babcock & Wilcox boilers. The quantity dealt with amounts at times to as much as 7,000,000 gallons per day, and the lift is fifty-two feet, the pumping engines developing 140 indicated horsepower. The steam generated in connection with the destructors of the Metropolitan Borough of Hackney is transferred to the electricity department. The statement of accounts for the year ended 31st March, 1908, showed that 38,308 tons of refuse were dealt with at an average rate of 124.4 tons per day. The amount of water evaporated per pound of refuse was 0.856 lbs. and the steam utilized by the electricity department totaled 73,464,675 lbs. For this the sum of 2,288 pounds, 1 shilling 3 pence was received by the public health department. In addition to this the sum of 62 pounds, 11 shillings, was realized by the sale of tin cans and residuals. The total cost of destroying the 38,308 tons amounted to 5,297 pounds 15 shillings, to which must be added

2,733 pounds 3 shillings 7 pence, being the repayment of principal and interest, so that the net cost of destruction, after crediting the value of the steam transferred to the electricity department and the sundry receipts amounted to 5,680 pounds 6 shillings 4 pence, or 2 shillings 11.6 pence per ton.

Combined Destructor and Electricity Station of the Borough of Fulham. The metropolitan borough of Fulham constructed their combined destructors and electricity works in 1901. There are twelve destructor furnaces of the standard Horsfall type, each having a grate area of 30 square feet, arranged in two groups of six each in two rows of three each, placed back to back. Between the two groups of cells are placed six Babcock & Wilcox boilers, each provided with Vicker's mechanical stokers electrically driven. The destructor gases are led into each of the boilers by means of an opening in front of the bridge, the flue to this opening being provided with a suitable damper, so that the boiler may either be heated from the destructor, or be fed with coal. Provision has also been made for firing the boilers by hand, in the event of interruption in the working of the mechanical stokers. Forced draught has been applied to each boiler. The refuse is fed into the destructor furnaces through charge openings on the tops of the blocks of cells. It is very roughly screened with a view to sorting out tin cans, etc., before it is put into the furnaces. The destructors are capable of dealing with ten tons of refuse per cell per twenty-four hours, and for every pound of refuse burned about 1½ pounds of water are evaporated. The forced draught is at present supplied by steam jets, which are admitted through cast iron side boxes, but arrangements are being made to admit the jets immediately under the gratings at the front of the cells. The temperature of the furnaces varies between 1800 deg. Fahrenheit and 2200 deg. Fahrenheit. The boilers were constructed for a pressure of 160 lbs. per square inch, but they are generally worked at a pressure of from 135 lbs. to 145 lbs. per square inch. It was originally estimated that about 40,000 tons of refuse would be dealt with per annum, and, placing its calorific value at one-twentieth that of good steam coal, a saving of 2,000 tons of coal per annum would be effected. The steam is used to work a horizontal compound condensing engine capable of giving 500 indicated horsepower when supplied with steam at 130 lbs. pressure. The engine drives a two-phase generator capable of giving a normal output of 300 kilowatts, each of the two sets of coils being capable of giving 150 kw. at all pressures from 2,800 to 3,000 volts at the terminals of the machines.

Combined Sewage Pumping Station and Refuse Destructors of the Twickenham Urban District. The installation consists of a pumping plant comprising two triple expansion vertical condensing engines with a capacity of 6,000,000 gallons per day, two Lancashire boilers connected to specially constructed furnaces for burning house refuse, one reserve Babcock & Wilcox boiler for use at times when the destructor furnaces are not available, with auxiliary plant for electric lighting, water supply, driving workshop tools and sludge ejectors. The electrical machinery consists of two 10 kw. steam dynamos, the engines being tandem compound taking steam at 125 lbs. Current at 200 volts is taken from the works by means of vulcanized bitumen insulated cables, and is used to light the Council's isolation hospital at Whitton, situated over a mile from the works. The current is transformed at the hospital by means of a rotary transformer to 50 volts, which is the pressure used throughout for lighting and power. The whole of the steam required to work the plant is raised from the burning of the house refuse. A test of the destructor was carried out in February, 1907, when it was found that 1.9 lbs. of water from and at a temperature of 212 deg. F. were evaporated per lb. of refuse consumed.

Combined Power Plant and Refuse Destructors of the Corporation of Bradford. The city of Bradford has four separate destructor installations, comprising twelve Horsfall cells arranged back to back in two groups of six cells each; twelve Horsfall cells arranged in a single row; six Horsfall cells in one row, and eight Manlove and Alliott cells. Steam is generated in three multitubular, one Lancashire and two Babcock & Wilcox boilers. The total power, which is produced entirely from the burning of the city's refuse, amounts to about 1,000 indicated horsepower. The power is utilized at the different instaliations by four engines, which drive twelve mortar pans and three crushing and screening plants, and by four combined high speed engines and dynamos for electric lighting purposes. It is also used to drive a complete

slab making plant with intensifiers and mechanical concrete mixers, a fish manure plant, and for supplying steam to the disinfecting station, and the power required in the various workshops. All the depots are lighted by electricity and the mess rooms and workshops are heated by steam pipes. It is estimated that the utilization of the steam for heating purposes has alone effected a saving of 60 pounds ($300) per annum.

Combined Electric Power Station and Destructor Installation of the Corporation of Preston. This installation was constructed in 1903. The destructor plant consists of a four-grate Meldrum Simplex Regenerative furnace, having a total grate area of 100 square feet. The furnace has a front feed and deals with about fifty-five tons of refuse per day. The forced draught is supplied from steam jets. There are four Lancashire boilers, each 30 feet long by 8 feet in diameter, and they are constructed for a working pressure of 200 lbs. per sq. inch. The steam is used to drive the engines generating the electricity for the tramway traction, each of which develops almost 500 indicated horsepower. In all about 20,000 board of trade units are generated per week.

Combined Sludge Pressing and Destructor works of the corporation of Ealing. The corporation of Ealing has one combined station for the purification of the sewage, the disposal of the refuse and the conversion of the residuals into paving slabs. The works are designed to deal with the sewage and refuse of a population of about 40,000 persons. The destructor installation consists of nine Manlove & Alliott cells placed side by side. About fifty tons of refuse are disposed of per day in winter, and 40 tons in summer, in addition to which an average of 70 tons of pressed sludge is burnt per week. Forced draught is supplied to the furnace by means of three fans driven by an independent engine. Steam is generated in two multitubular boilers, which are capable of raising sufficient steam to develop 100 indicated horsepower. The method of treating the sewage is as follows: The solids are chemically precipitated in continuous flow tanks by the addition of a small proportion of liquid lime. The clarified effluent is treated partly on contact beds, and partly in percolating filters. The precipitated sludge is drawn off from the tank through a screen designed to intercept rags, paper, etc. The materials arrested by the screen are removed by hand, and burnt in the destructors. The sludge is passed into a ram, and an air pressure of 80 lbs. to the square inch is applied, which forces it into three pressing machines. The compressed air is provided by two special engines working in connection with an air cylinder. The molds of the presses consist of a number of castings, made in two parts, to fit tightly together. Between each set of molds is placed a piece of coarse canvas. Holes are provided in the base of the castings, so that the liquid forced out of the sludge may drain away. This is pumped back to the sewage works for further treatment. The sludge is left in the presses for about one and a half hours, at the end of which time the cakes are fairly solid. These are then removed in small tip wagons to the hopper platform on to which the town refuse is emptied from the collecting carts. Here they are broken up, mixed with the refuse and delivered together into the furnaces. The whole of the steam required for these operations, and also for a complete slab making plant is derived solely from the burning of the refuse and the sludge cakes.

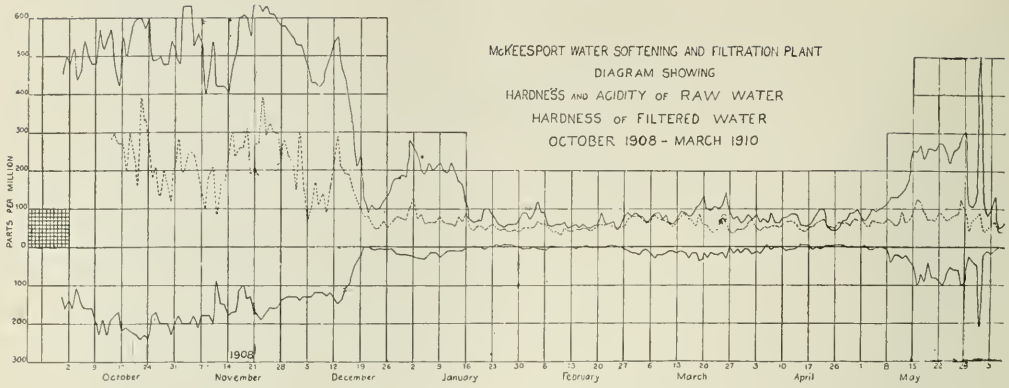
EXPERIENCE WITH AND RESULTS FROM MUNICIPAL WATER SOFTENING.*

By Alexander Potter, Consulting Engineer, New York City.

MUNICIPAL water softening is still in its infancy. Early experiences in municipal water softening in America were not satisfactory, but through no fault of the principles involved.

The theory of water softening is not new. The theory of the softening of waters containing a temporary hardness due to calcium and magnesium carbonates held in solution, by the presence of free carbon dioxide, was enunciated by Dr. Clarke, of England, some fifty years ago. The treatment of such waters consists of the addition of lime-water or milk of lime, applied in carefully regulated quantities. The resultant reaction is the immediate

*A paper before the American Water Works Association.

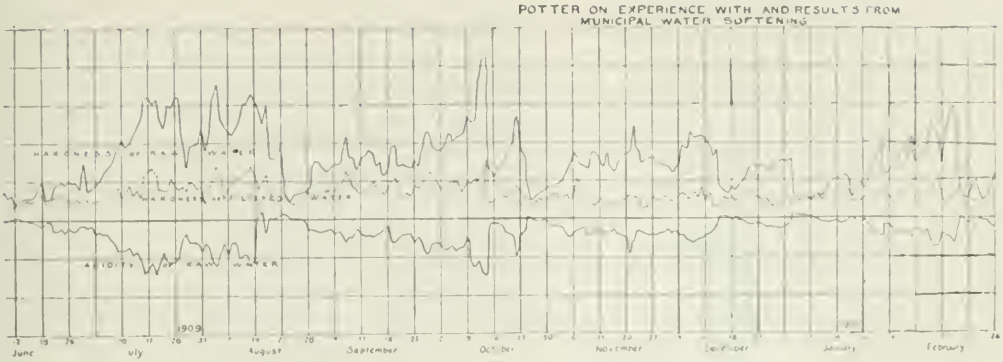


union of the added lime and the free carbon dioxide, causing the precipitation of calcium and magnesium carbonates.

Waters possessing permanent hardness, as well as those which are contaminated by mine or factory refuse imparting to the water metallic salts and free sulphuric acid in solution, cannot be thoroughly treated with lime alone. This hardness can be most economically counteracted by the use of lime and soda carbonate. This principle is familiarly known as the Porter-Clarke method, and although it was suggested over fifty years ago, no other process has been invented to supplant it during all these years. There are a number of different water softening systems on the market at the present time. The principal advantage of one system over another is simply one of economies in the distribution and use of chemicals, and the removal of waste products of the process.

So far in this country water softening has been employed in municipal plants only when, to use the vernacular, the cities employing it have been "up against it." This was notably the case in Winnipeg, Canada; Oberlin, Ohio; McKeesport, Pa., and Columbus, Ohio. Perhaps no city has ever been in greater need of nor has had a harder problem of water softening than the city of McKeesport, and the author was fortunate enough to be retained to advise a plan for its solution. For at least six months of each year, the water of McKeesport was fit neither for man nor beast, nor for any commercial purposes whatsoever, save, perhaps, for street sprinkling. So bad was the water supply at McKeesport that it was characterized in the United States geological reports as the worst water in the country. It was so bad that, notwithstanding confirmatory reports upon the plans proposed from persons qualified to judge as to the probable outcome of the treatment, money for the construction of the plant was appropriated reluctantly by the governing bodies. In fact, each time that the Board of Water Commissioners applied to councils for an appropriation to carry on the work of construction, it was the signal for a tirade of abuse on the part of some members of councils against the throwing away of the people's good money for something that was sure to prove an absolute failure. By emulating the motto, "keeping everlastingly at it brings success," we succeeded in completing the plant in record time under the greatest handicaps. So convinced was the author that the plant would handle the water satisfactorily even in its worst condition, that it was put into commission before its full completion. This was done because the river water was more highly acid at this time than at any previous time, and a test of the plant under such conditions was highly desirable.

An examination of the diagram accompanying this paper will show that the conditions existing during the first three months of the trying-out period, viz.: October, November and December, 1908, have not been duplicated since. During this period, also, the water consumption in the city was so great, due to imperfect plumbing fixtures, which had been eaten out by the action of sulphuric acid contained in the untreated water, and to faucets left open in the vain hope that the quality of the water would thus be improved, that the plant was called upon to treat practically the full quantity which the plant was designed ultimately to treat.



The high acidity in the McKeesport water is due to the large amount of mine water discharged into the tributary creeks of the Youghiogheny river, and to the spent acids from the galvanizing works along the shores of the Youghiogheny. The washings from the coke beds are another contributory cause. Furthermore, the difficulties of treating the Youghiogheny river water have been increased during the last few years by the abstraction from the water-shed of practically the entire flow of the Indian Creek, one of the main feeders of the Youghiogheny, and the transporting of this water for the benefit of the Pennsylvania railroad into an entirely different water-shed. The Indian Creek was one of the most permanent streams in the water-shed, and the water from this stream went a long way toward counteracting the effect of the impurities in the river.

The acidity in the water for a number of years previous to the operating of the plant was as follows:

Year		Av'g Acid'y	Max. Acid'y
		Parts per million	
1901		43.0	125.0
1902		42.1	200.0
1903		34.5	140.0
1904		50.6	170.0
1905		32.1	80.0
1906		28.0	120.0
1907		43.4	133.0
1909	Oct. to Dec.	150.0	240.0
1909		33.0	210.0

The acidity in the water since the plant was put into operation in October, 1908, is represented by the lowest curve on the diagram accompanying this paper. An examination of this diagram will convince the most skeptical of the variable character of the water to be treated. The water has jumped from a hardness of 110 at 4 o'clock in the morning to a hardness of 510 4 or five hours later, and from an acidity of 30 up to an acidity of 210 during the same period. To produce a uniform product from the plant under such conditions requires the greatest care and watchfulness on the part of the employes of the plant. An examination of the curve of hardness of filtered water will indicate that a reasonably uniform product has been obtained.

The McKeesport plant was fully described by the author in a paper read before the Engineers' Society of Pennsylvania, and appears fully illustrated in their journal for April, 1909. The technical weeklies have also described the plant at various times. It is therefore unnecessary to consume the time of the association with a description of the plant. Anyone interested is respectfully referred to the publications mentioned.

Novel features of the plant which might be mentioned and which a year and a half of operation have given a sufficient test, are as follows:

The method of cleaning the settling tanks without emptying them or interfering in any way with the continuous operation of the plant. Carriers are built under the floor of the settling tanks. The carriers in each of the four tanks are divided into four zones. Small circular holes ⅞ inch in diameter, spaced 4 feet apart, connect the bottoms of the tanks with the carriers. The outlet end of each set of carriers is controlled by a valve. In cleaning the basins the valve controlling each zone is kept open until the precipitated solids are removed and the water runs free from sludge. The amount of water used in cleaning the settling tanks and baffling tank is approximately 1,700 gallons per day for each degree of hardness in the water.

Another novel feature in the plant

Week Ending	Character of Water and Amount Used							
	Alkalinity		Hardness		Amt. F. W. Pumped Million Gallons	Wash Water		
	Parts Per Million					No. of Hrs. between Washings of Filters	Amt Per Day Gals	% of F. W.
	R.W.	F.W.	R.W.	F.W.				
February 13	0	38	57	43	3.795	202	21,428	0.55
February 20	+ 0.7	42	54	48	3.582	336	12,856	0.36
February 27	+ 1.0	47	65	56	3.516	336	12,856	0.37
March 6	− 12.0	51	80	74	3.484	252	17,143	0.49
March 13	− 17.0	58	75	68	3.464	252	17,143	0.50
March 20	− 21.0	46	99	72	3.462	504	8,571	0.25
March 27	− 19.0	31	107	57	3.917	168	25,714	0.66
April 3	− 10.0	34	76	52	3.607	144	30,000	0.82
April 10	− 2.0	27	72	53	3.600	202	21,428	0.60
April 17	− 1.0	22	72	54	3.645	144	30,000	0.80
April 24	+ 1.0	24	72	60	3.699	202	21,428	0.60
May 1	+ 1.0	22	79	65	3.490	202	21,428	0.60
May 8	− 1.0	19	95	66	3.743	144	30,000	0.80
May 15	− 30.0	34	162	73	3.942	168	25,714	0.65
May 22	− 79.0	41	256	92	3.944	252	17,143	0.40
May 29	− 76 0	32	264	88	4.125	72	55,714	1.40
June 5	− 51.0	31	163	62	4.010	101	40,000	1.00
June 12	0	33	69	47	4.064	101	28,571	0.70
June 19	− 5.0	29	66	51	3.877	112	25,714	0.70
June 26	− 21.0	30	87	55	4.074	101	28,571	0.70
July 3	− 28.0	32	95	48	4.491	92	31,429	0.70
July 10	− 53 0	33	152	68	4.362	92	31,429	0.70
July 17	−101.0	32	250	86	4,614	63	45,714	1.00
July 24	−111.0	34	291	99	3.972	84	34,286	0 90
July 31	− 63.0	34	215	86	4.284	46	62,857	1.50
August 7	− 85.0	37	262	91	4.586	40	71,428	1.60
August 14	− 89 0	39	281	114	4.743	36	80,000	1.70
August 21	+ 4.0	32	119	70	4.478	46	62,857	1.40
August 28	0	31	69	56	4.374	126	25,000	0.60
September 4	− 29.0	31	139	71	4.210	40	72,214	1 70
September 11	− 41.0	25	164	91	3.922	63	45,714	1 20
September 18	− 35.0	25	152	81	4.091	72	40,000	1.00
September 25	− 49.0	26	157	78	3.934	59	48,571	1 20
October 2	− 68.0	26	188	100	3.819	56	51,429	1.30
October 9	− 81.0	23	220	88	3.530	112	25,714	0 70
October 16	−109.0	38	280	83	3.704	92	45,714	1.30
October 23	− 39.0	36	178	68	3.497	336	8,571	0.24
October 30	− 7.0	30	82	52	3.341	168	17,143	0.51
November 6	− 22.0	40	112	59	3.355	202	14,286	0.30
November 13	− 34.0	36	153	57	3.572	168	17,143	0.50
November 20	− 38.0	35	149	42	3.376	144	20,000	0.60
November 27	− 50.0	34	174	48	3.535	202	14,286	0.40
December 4	− 37.0	32	140	51	3.528	168	17,143	0.50
December 11	− 50.0	31	208	61	3.714	252	11,429	0.30
December 18	− 13.0	31	119	48	4.250	101	28,571	0.70
December 25	− 10.0	25	111	59	4.332	252	11,429	0.30
January 1	− 23.0	28	143	43	4.631	144	20,000	0.40
January 7	+ 5.0	20	82	42	4.387	101	30,000	0.70
January 15	− 8.0	28	78	58	4.442	168	17,143	0.40
January 22	− 6.0	34	89	58	3.894	202	14,287	0.40
January 29	− 27.0	28	140	64	3.965	202	14,286	0.40
February 5	− 38.0	32	168	67	3.716	144	20,000	0.50
February 12	− 50.0	32	193	65	4.063	144	20,000	0.50
February 19	− 30.0	29	116	50	4.286	126	25,000	0.60
February 26	− 13.0	26	81	41	4.135	168	20,000	0.50
Average	− 33.0	32.5	139	66	3 928	152	29,235	0 72

RESULTS OF WATER SOFTENING AT

Treatment of Water								Cost of Treatment of Water				
Lime		Soda Ash		Coagulant		Hypochlorite of Lime		Chemicals		Labor		
Per Day Pounds	Million Gallons Pounds	Per Day Pounds	Million Gallons Pounds	Per Day Pounds	Per Million Gallons Pounds	Per Day Pounds	Per Million Gallons Pounds	Per Day	Per Million Gallons	Per Day	Per Million Gallons	Total Cost per Million Gallons
800	212	4,929	509	400	152			$24 00	$6 32	$37 27	$9 83	$16.15
600	166	1,800	500	743	207			24 14	6 72	35 94	10 00	16 72
914	261	2,186	623	1,186	213			31 69	9 02	29 91	8 49	17.51
1,000	286	2,700	773	686	196			34 58	9 92	29 49	8 44	18.36
514	148	3,086	892	400	116			35 69	10 32	30 76	8 82	19.14
3,057	885	4,114	1,190	457	132			55.11	15 90	31.12	9.00	24 90
3,600	918	3,857	984	171	44			53 53	13 65	29.67	7 57	21.22
3,543	980	2,443	676	1,200	333			44.99	12 50	30 94	8.56	21 06
1,714	476	1,800	502	800	222			28.86	8 00	30 49	8 46	16.46
1,371	376	1,671	458	571	157			24.97	6 84	30 51	8 26	15 10
1,886	506	1,029	277	286	77			10.38	5 25	30 94	8.38	13 63
2,314	671	1,157	331	800	229			25.22	7 23	31 44	8.97	16 20
4,000	1,068	2,314	618	629	168			41.82	11.14	31 44	8 40	19.54
3,371	854	4,757	1,208	114	29			60.77	15.47	30.07	7 63	23.10
6,657	1,690	6,668	1,690					92 48	23.52	29 55	7.53	31.05
6,628	1,608	6,086	1,480					86.54	20.98	31.44	7.62	28.60
3,286	3,820	3,343	857	114	28			49.05	12.27	30.69	7.63	19.90
1,657	408	2,318	571	971	238			34 00	8 38	31.44	7 72	16.10
886	227	1,800	464	686	177			23 72	6 10	31.22	8.07	14 17
1,343	331	2,314	569					26.63	6 54	31 44	7 72	14 26
1,657	368	3,857	860					41.80	9.30	31.44	6.98	16 28
2,942	673	5,657	1,300					63.12	14 46	30.85	7.06	21.52
6,429	1,400	10,019	2,170	228	49			119.40	15 84	32 72	6 88	32.90
5,857	1,480	10,286	2,580	57	14			117 19	29 52	31.29	7 88	37.40
3,886	908	6,429	1,498					73 74	17.17	31.01	7.25	24.42
6,257	1,360	9,514	2,072					111 74	24 31	31.01	6 79	31.10
6,114	1,385	10,029	2,120					115.78	24.44	29.98	6.36	30.80
5,857	638	3,600	805	772	172			49.10	11.02	31.01	6 88	17 90
1,886	431	2,314	529	578	132			32.29	7.35	31.01	7 07	14.42
3,600	851	3,871	918					49.66	11.76	31 01	7.34	19 10
4,000	1,020	3,857	985					51.31	13.08	31.01	7.90	20.98
2,400	586	3,343	818					40.06	9.78	31.01	7.58	17.36
3,257	827	4,629	1,178					55 20	14.01	29 49	7.49	21 50
4,857	1,275	5,400	1,420					68.76	17.96	29 98	7.84	25.80
4,287	1,214	6,657	1,890					77.96	22.03	31.01	8.77	30.80
5,514	1,492	10,543	2,850	118	32			118.80	32.11	29.51	7.96	40.10
2,971	851	5,143	1,470					58.62	16.78	31.01	8 82	25.60
1,800	539	2,314	692	172	51			29.84	8 93	31.01	9.27	18.20
1,000	297	3,859	1,180	286	85			40.43	12.04	31.01	9 26	21.30
3,000	840	4,886	1,368			21	6	57.80	16 22	30.19	8.44	24.66
3.000	886	4,886	1,448			29	10	58.14	17.17	31.01	9.19	26.36
3.000	847	5,914	1,668			23	6	67 05	18 98	31 01	8 76	27 74
3.000	850	4,371	1,238			6	2	52 14	14.78	31 01	8.76	23 56
3 000	808	6,171	1,660					68 28	18.40	31.22	8 40	26.80
3,000	706	4,114	966	258	61			51 09	12.24	31 22	7.34	19.58
3 000	693	2,829	653			23	5	39 28	9.08	30.58	7.06	16.14
3,000	646	5,143	1,108	20	4			51.36	11 09	31.22	6.74	17.83
1,571	358	2,314	528	714	161	6	1	31 62	7 21	31.01	7.06	14 29
571	128	2,057	463	257	58	26	6	24.91	5.61	30 68	6.90	12 51
1,286	330	2,314	592	457	117	46	12	33.85	8.69	30.97	7.95	16.64
2.600	656	3,600	910	457	115	10	3	46.22	11.65	31.82	8.03	19.71
3,057	823	5,143	1,382			10	3	59.59	16.04	31.68	8.53	24.57
3,514	753	6,171	1,516			10	3	70.34	17.32	31.82	7.83	25.15
3,029	708	3,857	899			14	5	47.55	11 12	31.82	7.43	18.55
1,457	352	1,543	373			20	5	20.38	4.92	29.25	7.06	11.98
2,930	750	4 100	1,046	292	76	15 0	4 0	$52.95	$13.36	$31.16	$8.06	$21.41

McKEESPORT, PA., FEBRUARY, 1909, TO MAY, 1910.

is the economic use of wash water. The entire machinery is operated by a water motor located on the top floor of the softening building. The waste water from the motor enters the wash water basin for the filters. This water, charged against the plant as power, should not be charged as wash water, thus effecting a substantial saving. The amount of wash water shown in the annexed table is, however, the actual amount of water used in washing the filters, and amounts to 0.72 per cent. of the total amount pumped.

Still another feature in the McKeesport plant is the arrangement for the entry of water into and exit of water from the settling basins. The design of the plant allows the water to enter the settling tanks over a long weir with a relatively short travel through the tank to the long overflow weir, with a gradual reduction in velocity as it approaches the outlet weir. For a given capacity of tank the longer the weirs and the shorter the travel through the tank to the overflow, the less the velocity, and consequently the greater the precipitation. The water as it leaves the settling tanks is perfectly clear and free from turbidity.

The character of the McKeesport water is so unusual that tables of cost of operation are apt to be misleading to other municipalities, because the persons seeking data of cost and practicability of water softening are apt to be swayed adversely in their opinions by applying to their own cases the costs of producing a softened water at other places, as for instance, at McKeesport, without taking into consideration the possible differences in conditions between the water to be dealt with at different places.

The only fair way to analyze the cost of any particular plant is to weigh the cost thereof against the benefits to be derived therefrom. Bearing this in mind, we have on the one hand to consider: (a) first cost of plant; (b) cost of operation. As against this we must also consider (c) the improvement in the water; (d) the decrease in operating expenses of the plant; (e) decrease in wear and tear upon the plant; (f) decrease in plumbing bills paid directly by private citizens; (g) the decrease in the cost of soap; (h) lengthening the wear of linens, flannels and other fabrics, and (i) increase in the length of life of boilers.

Taking the case of McKeesport, the annual interest on the cost of construction is approximately $10,000.

The cost of operation for one year is $30,700.

The total cost of producing 4,000,000 gallons of softened filtered water a day is $40,700 per annum.

Against this we have the following saving:

Since the softening plant has been installed the water department has dispensed with a number of its employes engaged on repairing curb connections, whose wages, according to the president of the Board of Water Commissioners, amounted to $15,000.

The private consumers expended annually in maintaining their plumbing fixtures over $35,000.

Since the softening plant has been installed only 72 per cent. of the water previously required is now pumped, thus making a reduction in the coal consumption of $6,090 per annum.

The reduction in repairs of plant amounts to $3,000 a year.

From the best evidence obtainable, the saving in soap and soap compounds alone amounts to over $10,000 a year, and the saving in the wear and tear in washing of fabrics of all kinds can be set down at $20,000 a year.

Summarizing these, we have, on the one hand an added cost of treating the water of $40,700; and on the other, a saving, as enumerated above, of $89,090.

This balance sheet shows that the introduction of the water softening plant for the city of McKeesport, instead of being an added burden to the people, has proved to be a saving of $48,390 per annum.

As a side light upon the saving effected in the McKeesport plant it may be stated that before the water softening plant was put into commission about 156 plumbers were at work in the city. Out of this number only 46 were left four months after the plant was put into commission, and at the present time about the same average number of plumbers are employed in McKeesport.

In making the above comparison the author has not touched upon the saving in life due to the reduction in typhoid fever, which has been quite marked, for he believes it is not altogether fair to take the difference in the death rate for the year before and the year following the introduction of such an improvement and credit this saving of life wholly to the water treatment plant, because for such a comparatively short period there may

have been many other causes contributing to the reduction of the death rate. It is fair to assume, however, that no one factor was more responsible for the reduction in the typhoid fever death rate than the water treating plant.

Beside all these considerations there stands out prominently the fact that the McKeesport water now has that palatable, crisp, fresh taste which is delightfully refreshing, a quality often lacking in public water supplies. The water is acceptable for drinking, cooking and bathing alike. A greater cleanliness on the part of the people is also observed generally throughout the city.

The author presents herewith a table showing the characteristics of the water from week to week; also the amount of lime and other chemicals used in the treatment of it, together with the cost of treatment.

The plant at McKeesport includes a filtration plant, which is in itself an interesting study, aside from the softening plant.

During the summer of 1909, when the bacterial count in the raw water ran from 5 to 100 or 200, the bacteria in the settled and filtered water showed increases over the number in the raw water. The numerical increase in the bacteria in the filtered water over the raw water completely annihilated removal or efficiency percentages and did not present a very creditable showing. Furthermore, it was impossible to determine the character of the bacteria on any one day until two days later, consequently there was always a possibility, when the raw water contained bacilli coli, of their passing through the filter as well. It is important to note also that so far as the reduction of bacteria is concerned the filters failed to produce any reduction over the settled water. In fact, it is the exception rather than the rule that the bacterial count of the filtered water is lower than the bacterial count in the settled water; all of which goes to show that, in a water similar to that treated at McKeesport, it is possible to dispense with the filter entirely.

Consequently, in October, 1909, the use of hypochlorite of lime was used at the suggestion of the author, and has been in use ever since. The effect of the use of hypochlorite of lime has been to almost completely sterilize the water in the softening plant. The use of a sterilizing agent is a sufficient safety factor for destroying bacteria that would not otherwise be entangled and brought down with the precipitates in the settling basins. The amount of hypochlorite of lime used varied from 2½ to 12 lbs. per million gallons, and averages 4 lbs. per million gallons. In the McKeesport plant the hypochlorite of lime is admitted at the entrance of the baffle mixing tanks about one hour before the soda is admitted to the baffle mixing tanks. The hypochlorite of lime is dissolved in the coagulant tanks, and the coagulant pumps are used for the application of the hypochlorite to the water.

No coagulant has been used since the application of the hypochlorite of lime. A remarkable condition exists with the water at McKeesport, where, with 450,000 bacteria and 1,500 turbidity in the raw water, no coagulant was used, and yet a clear water was secured from the filters.

In the opinion of the author there are very many towns in which the introduction of water softening, coupled with the use of some sterilizing agent, would present the most satisfactory solution of the water purification problem, and be commercially more desirable.

It is to be hoped that this phase of the question will receive greater attention than in the past, for it at once makes commercially available the treatment of waters for other than purely sanitary purposes. There are so many cities throughout the United States and Canada afflicted with hard waters that the purely commercial aspect of water softening must demand attention to a greater degree in the future than it has in the past. The benefits of a soft water are fully as valuable to the private citizen in the uses to which he puts his water supply as they are to the large manufacturing concerns, which, it is well known, are being forced to install private softening plants for the preservation of their boilers, and the percentage of saving to the private citizen by the introduction of softened water will be found to be just as great proportionately as the saving to the manufacturer.

The average cost of chemicals at the McKeesport plant during the last year was as follows:

	Per ton of 2,000 lbs.
Lime	$ 8 30
Soda ash	18 00
Sulphate of iron	11 00
Alum	12 50
Hypochlorite of lime	42 00

The character of the water at McKeesport perhaps requires the application of a greater amount of chemicals per million gallons than any other water in the country, and the satisfactory results obtained should go a long way toward dissipating the somewhat prevalent idea that the use of chemicals in water treatment is injurious to health.

EFFECT OF SEWAGE AND SEWAGE GASES ON CONCRETE.*

By Sydney H. Chambers, Engineer to the Hampton Urban District Council, Hampton, England.

THE subject of the present communication, the author stated, was one in regard to which it might be assumed that the available evidence was either inconclusive or of a more or less negative character. For, notwithstanding that cases were on record of destructive changes in tanks and sewers, the opinion tended to prevail that when the concrete construction was sound no marked disintegration need be anticipated, either from sewage or from its emanations.

The author's experience, however, did not support this view, and it was to the elaboration of this, the positive side of the question, that he desired to direct attention. During the last five or six years he had had very special opportunities for studying the problem.

In order to be in a position to more fully appreciate the disintegratory changes occurring at Hampton, and the deductions drawn from them, the author thought it was necessary to describe, even though briefly, the installation in question, and to state the character of the sewage, as well as to outline the nature of the materials used in the construction of the tank and channels.

THE HAMPTON INSTALLATION.

The nature of the sewerage system was water carriage, primarily flowing by gravitation, and, secondarily, raised by plenum pneumatic power. The sewerage was entirely and completely on the separate system. The installation consisted of a screening chamber, two detritus tanks, a hydraulic tank, and triple-contact beds, and an air-purifying filter.

The sewage on its arrival at the works was delivered from the rising main into the screening chamber, and after passing through the screen, was conveyed by a channel to the detritus tanks. From these tanks the sewage entered the hydrolitic tank, which, together with the detritus tank, was installed in 1903. The disposition of the tank was such that the main bulk of the sewage—80 per cent.— passed through at a comparatively high rate of flow, issuing in four hours as a clarified liquid, while the small volume—20 per cent.—containing the deposited matters, was sixteen hours in the tank. After flowing over the weirs of the first portion the liquid entered a channel which led to the second portion of the tank, consisting of four hydrolysing chambers arranged in sequence, and filled with large flint stones. The liquid having taken three hours in its passage through these four chambers, entered the lower channel, which conducted it to the contact beds.

The screening chamber, the tank, and the channels leading to and from the tank, as also the effluent channel of the primary contact beds, were covered in. The entire installation was ventilated by the hydro-mechanical system of sewer ventilation, and the withdrawn gases were purified by being passed through an air filter.

The sewage of Hampton was of a strong domestic character. It had undergone thorough disintegration by the lifting operations, and by the putrefactive changes occurring in the rising main. It was malodorous on its arrival at the screening chamber, where as it left the rising main, it evolved sulphuretted hydrogen and other bad-smelling compounds. The liberation of these gases constituted a nuisance necessitating the screening chamber, channels, and tank being covered in, and means being provided for drawing a large volume of air through them before discharging the gases into the atmosphere.

THE CONCRETE USED.

The whole of the tank and channels,

*Abstract by *The Surveyor and Municipal and County Engineer* of a paper before the Concrete Institute.

the author said, were constructed of Portland cement concrete. The walls of the tank are 6 ft. 6 in. in thickness at the base, and 1 ft. 6 in. at the top, and are strengthened by tie-rods; the roof was 6 in. in depth and was reinforced by "expanded metal" paving slabs. The work was executed by departmental labor, and the best materials were used.

The concrete was composed of 1 part of Portland cement properly mixed with clean water and 6 parts of ballast thoroughly free from loam, clay, mud or dirt of any kind, and no material was allowed to be used larger than would pass through a 2-in. screen.

The makers of the "indurated" paving flags state that they are composed of Mountsorrel granite chippings, washed and crushed to pass through a ¼-in. mesh sieve, and heavy Portland cement made by themselves, the raw material for which is obtained from the Barrow-on-Soar blue lias beds. The materials are mixed in the proportion of 1 part of cement to 3 parts of granite.

EFFLORESCENCE.

Early in 1905, a few months after the hydrolytic tank had been put into use, it was noticed that the roof and walls of the hydrolysing chambers above the liquid level were white or yellowish in appearance. This efflorescence was not crystalline in structure, but was of a chalky subsistence, and resembled distempered work on a damp wall. On examination it was found to be due to a thin covering of sulphur, which could be easily removed by rubbing. Later the face of the walls and the roof in the second part of the tank showed signs of peeling, and the concrete appeared to be disintegrating. A thorough inspection of the installation was thereupon made.

DISINTEGRATION.

At the screening chamber nothing appreciable was observed, either at the highest water level or on the underside of the roof. The concrete was sound, and when struck had a good ring. Immediately adjoining this chamber was the main sewage inlet channel, along which the whole of the gases pass to the main air duct leading to the air filter. At this point slots were made in the concrete to receive a dam; the concrete at the back of the grooves was found to have disintegrated, although the sides were perfectly sound.

Further along this channel it was observed that the greatest disintegration had taken place on the walls at the liquid level. Owing to variations in the flow of the sewage, the level of the liquid in the tank and channels rose and fell; thus a certain area of the walls was constantly immersed in the sewage, and then exposed to the air. This area was, consequently, even when not immersed, much wetter than the part of the walls which was always above the level of the liquid. The latter area at this point showed erosion, which, however, had not penetrated so deeply as that at the level of the liquid itself. At the liquid level there was a deep groove in the concrete, and above this the face of the work had bulged out and lost its nature.

The first portion of the tank—i. e., the hydrolytic tank proper—appeared to have suffered very little. The walls and roof had only the slight sulphur deposit. At the liquid level, which varied less than in the channel, there was a slight erosion. The second part of the tank—i. e., the hydrolysing chambers—was found to have suffered in places to a marked degree. It was observed on breaking through the erosion on the surface that the concrete at the back was moist, soft and gritty. Also, it was noticed that increased dampness constituted an important factor in the destruction of the concrete, for the lower parts of the vertical faces of the beams supporting the roof were more affected than the upper parts. The lower portions of the vertical walls of the tank also were more eroded than the opper. At the liquid level the concrete had been severely attacked, and a deep groove existed in it.

ANALYSES OF CONCRETE IN HYDROLYTIC TANK.

Two samples of surface concrete were taken above and below the liquid level, and the following was the result of the analysis:

	Below liquid level. Sound.	Above liquid level. Unsound.
Appearance	Grey	White
Texture	Hard	Soft
Ratio cement to sand	1 : 2	3 : 2
Sulphate of lime in c'm't	Trace	66 per cent.

CONSIDERABLE DETERIORATION.

The same pronounced effect was to be seen in connection with the concrete blocks, which were grooved to receive sliding boards and project above the liquid level; these blocks had in many instances crumbled away to such an extent as to be almost shapeless. Recently these chambers

were emptied, and it was found that the concrete below the liquid level was perfectly sound and in a good state of preservation.

The lower channel conveying the liquid from the tank to the contact beds revealed the same characteristics as were observed in the upper channel, but the portion at the liquid level was very much more markedly affected.

ANALYSES OF THE DISINTEGRATED CONCRETE IN THE CHANNELS.

Samples taken of the lining of the sides and covering gave the following analysis:

	Ratio. Cement.	Sand.	Sulphate of lime in cement
1. Concrete at varying liquid level	1	2	70.26 per ct.
2. Underside of slab forming cov'r'g	5	1	74.61 per ct.

The air duct taking the gases from the effluent channel of the primary beds and communicating with the tank outlet channel was found to have a coating similar in appearance to that observed on the underside of the covering to the channels.

ANALYSES OF CONCRETE IN AIR DUCT.

Analyses of this coating were made, with the following results:

	Ratio. Cement.	Sand.	Sulphate of lime in cement
Underside of slab forming cover of air duct	2	1	70.71 per ct.

CONVERSION TO SULPHATE OF LIME.

The point to observe in the above analyses was the conversion of the lime in the cement into sulphate of lime, the sulphur being obtained from the sewage flowing through the tank and channels, as well as from the gases expelled from the sewage, and contained in the air withdrawn from the several parts of the installation.

SUGGESTED EXPLANATION.

Much thought had been given to the explanation of the foregoing observations, and it had been concluded that the effects had arisen from the putridity of the sewage and the oxidation of the putrid products by the air supply. The main erosive effect was at the varying liquid level, and was there dependent upon the amount of sulphuretted hydrogen in solution in the liquid. The gas was comparatively small in amount in the incoming sewage and in the liquid in the hydrolytic tank, and increased as the liquid passed through the hydrolising chambers. The results of this were especially well shown in the two channels; the alternate wet and dry area of the upper channel conveying the sewage from the rising main was less markedly affected, while in the lower channel the corresponding area was severely attacked. So with the two parts of the tank; the first part into which the sewage was delivered, and wherein comparatively little putrefaction took place, had not been affected to anything like the extent that the second part or hydrolising chambers had.

When the level of the liquid fell it left the concrete which it previously covered wetted with a liquid containing sulphuretted hydrogen in solution. This wet surface was then exposed to the action of the air supply, which oxidised the sulphuretted hydrogen with the production of sulphur and sulphuric acids; these decomposed the concrete, the lime being converted finally into sulphate of lime. What the exact nature of the intermediate compounds was could not be stated, as none of them had been isolated, but it was probable that the active agent was sulphurous acid, as it was known that cement was insoluble in sulphuric acid. When the liquid rose again, the decomposed concrete was washed away either wholly or in part, and a fresh surface was exposed to action when the liquid fell again. It was the continuation of this cycle which led to the formation of the grooves at the varying liquid level.

CONCRETE ABOVE THE LIQUID LEVEL.

The erosive effects on the concrete above the liquid level were dependent upon the sulphuretted hydrogen evolved from the liquid and mixed with the air supply. Some of this gas was dissolved by the moisture which was present on the walls and roofs, from evaporation and condensation; it was then oxidised by the air, and decomposed the concrete as described above. In this case the decomposed concrete either remained as a coating on the surface, peeled off, or crumbled away.

EFFECT ON CONCRETE TUBES.

In order to observe the phenomenon on concrete tubes, two 9-in. concrete tubes were selected, which were supplied by the makers of the paving slabs previously referred to, and were composed also of similar materials in the same proportion. One of the tubes was coated with Dr. Angus Smith's composition (coal tar, pitch, linseed oil, and resin). They were placed side by side in the second part of the tank

in such a position that they would be subjected to the rise and fall in the level of the liquid. At low level the tubes were not in contact with the liquid, and at high level the liquid rose to half the diameter.

After the tubes had remained in the tank for eight months they were taken out and examined. The coated tube did not appear to have been affected, other than at the highest liquid level, where a thin line could be observed, and when struck it was found hard and had a good sound. It was noticed that there were two areas on this tube without any coating, due no doubt to its having been placed upon two supports to allow it to dry; these areas were soft on the surface and similar to the uncoated tube. With these exceptions the tube appeared to be in as good a condition as when first placed in the tank. On the other hand, the uncoated tube had a distinct line at the highest liquid level, which was found to be soft, and when tapped with a chisel had a dull sound; the interior of the tube which had been immersed appeared soft and had a dull sound when struck; the portion of the tube above the liquid level was unaffected, and when struck had a clear ring.

The author then referred to other cases of disintegration of concrete by sulphur compounds.

CONCLUSIONS.

The deductions to be drawn from the investigations were that the gases in solution in sewage, and those expelled from it, arising from its decomposition, do act injuriously upon Portland cement concrete, notwithstanding the fact that the concrete is constituted of sound and good materials, when the following conditions prevail:

(1) A high degree of putrescence of the sewage.

(2) A moistened surface, which held or absorbed the putrid gases.

(3) The presence of a free air supply.

Further, that in the absence of one or other of the above enumerated factors little danger from erosion need be feared.

FACTORS THAT SHOULD BE CONSIDERED IN MAKING STREET LIGHTING CONTRACTS.*

By S. M. Rust, Greenville Electric Light and Power Co., Greenville, O.

THERE are 143 private corporations in Ohio engaged in the business of furnishing electricity to the public, and of this number more than three-fourths are dependent upon the street lighting of their respective municipalities for their financial success. In almost every other line of business when the success or failure of the entire concern depended upon the business of one customer the factors which enter into that business would be well known to both parties and a basis arrived at which would be satisfactory to all concerned in the contract. But in making street lighting contracts with municipalities the game so far has been a catch as you can affair with one side at least generally ignorant of what they were doing and suspicious of the other because they were ignorant and because they were of necessity compelled to deal with a monopoly.

I think it will be agreed by all present that if this part of the lighting business was understood by the municipalities as well as by the companies making the contracts, there would be better prices and more satisfactory contracts made.

It is not my intention to state just what the prices for street lighting should be, as prices must vary with different localities and are dependent upon the amount of lighting, cost of fuel, cost of equipment and labor, kind of lights, lengths of contracts, etc., but there are some factors which enter into this branch of the lighting business which each party to the contract should know of and for which they should make due allowance in making such agreement. These factors I group into the folowing heads:

Length of contract, kind and number of lights, changes in position of lamps, outages, schedule burned, time of payment, costs of service and manner of contracting.

The length of time that a street lighting contract should run is a very essential factor to be considered by both parties to the bargain. The stat-

*From a paper before the Ohio Electric Light Association.

utes of Ohio have fixed the maximum at ten years. The question is, should contracts be for any less period. If the company is a progressive one and keeps abreast of the times in adopting new improvements for their street lighting service, it should most assuredly not be less, as every such company can count upon completely changing its street lighting equipment at least once in every ten years, and this calls for an outlay that shorter time contracts will not justify. Every street lighting contract should provide that the company furnishing the lights should have the right to change their system to a newer or better system of equal or better intensity during the life of the contract, subject to the approval of the Council or Board making the contract. Instead of this provision injuring the municipality, it would benefit it by giving it the benefit of the improvements in electrical service which are appearing quite frequently, and it would be an incentive to the company to furnish the city with the best and up-to-date service. The proper method of dealing with outages is probably yet to be found. To compel the company to stand the exact price of the lamp when it is extinguished and should be burning is unfair to the company, because of the equipment cost and fixed expenses which always exist, while to excuse the company for continued outage would likewise be unfair to the municipality. A good plan is to agree in the contract just what the outage should be per hour per lamp, and it is suggested that the amount be two-thirds of the price received for the lighting of the lamp.

The kind of lamps to be used in lighting a town or city must depend somewhat upon the size of the municipality. Companies should be careful not to overlight a city in the beginning, as all municipalities grow rapidly and there is a constant increase in the number of light wanted, the lighting bill may become too great in comparison to other city expenditures and produce dissatisfaction. While most municipalities do not make any mistake in this regard and are generally under lighted, there are some that have more lights than the city can well afford to pay for. This is like overselling a man in goods. He may pay for the goods, but always results in a dissatisfied customer. So far there has been nothing invented for street lighting superior to the arc lamp. Its reliability, invention of its rays and ease of arranging its circuits had made it a favorite in any contract for street lights. In view of the recent inventions of the series tungstens, a price should always be agreed to for the installation of smaller units in out of the way places in order that the city may light dark spots at a less cost than the arc lamp, which is too large for the purpose. Series tungstens are now made to fit the amperage of almost every size arc lamp and can be installed on the same circuit and operated simultaneously with the arc lamps. Reports from this class of lighting are all favorable as to its satisfactory operation and length of life. In the smaller municipalities it is a question whether the series tungsten will not in time supplant arc lighting entirely. Its economy of consumption and consequently lower price will enable the introduction of a largely increased number and avoid the shadows of foliage, which is always dense in the smaller towns.

The number of lights that a municipality can use will determine in some measure the price that should be paid. At the end of this paper will be found an estimate of the cost of operating a 100 lamp street lighting outfit and it may be safely said that if the number is decreased the cost is increased and further that the price for a street lamp should not be fixed without taking into consideration the fact that the fixed expenses of the plant, sometimes called overhead expenses, will be the same whether 50 or 100 are contracted for.

The schedule that lamps are to be burned must also depend upon the size of the municipality. The writer is inclined to think that it is a mistake to furnish all night and every night service in towns of less than 5,000 inhabitants. For such towns a moonlight schedule is preferable, but every contract should provide that in case the nights are cloudy or stormy, that the lights should be burned during such conditions. Where the town is above 5,000 and under 10,000 inhabitants, it is a very good plan to have the contract provide for four lights off in each month, unless they are stormy or cloudy. By doing this the plant is enabled to make repairs to its arc lighting equipment, without sustaining outages, and plants in cities of this size can not afford to have so large an equipment as will guarantee continuous service. Cities that are above 10,000 will usually require all night and every night service, and cities of this class will usually justify a sufficiently extensive electrical

equipment, that will enable the company to give every day service on its street light service without inconvenience.

The time at which bills should be paid should always be stated in the contract. It is preferable to make it monthly. To allow bills to grow too large causes the public to murmur at their size, and in addition it is just as easy for the city to appropriate in its semi-annual appropriation as it is to allow bills to run on and be paid quarterly or semi-annually, besides it is a great convenience to the company to have the use of the money, as the sum usually received for street lighting is sufficient to take care of the operating costs in a considerable measure.

The manner of contracting in Ohio has been the subject of considerable controversy, but it seems to be the practice to make such contracts without competitive bidding, as a very large proportion of the contracts of Ohio have been made without such bidding. Section 2491 of the Revised Statutes, provides, that the muncipal corporation may contract with such company for supplying with electric light, natural or artificial gas, for the purpose of lighting the streets, squares and other public places and buildings, in the corporate limits. And Section 1536—205, and being Section 45 of the Municipal Code, provides, "that the council of any city may authorize and the council of any village may make (subject to the provisions of Section 2491 and 3551 of the Revised Statutes of Ohio), a contract with any person, firm or company for lighting the streets, lanes, lands, alleys, squares and public places in the municipal corporation, for a period not exceeding ten years, and the requirement of a certificate that the necessary money is in the treasury shall not apply to such contract."

Interpreting this latter section according to its language, it would be impossible for the council to authorize the board of public service, in a city, to make a contract until such person had been ascertained, and it was evidently the intention that the council should authorize a contract with a company and in cities the board of public service would have to carry out the contract, as authorized by the council. In over three-fourths of the cities of Ohio, this course has been followed and should be the proper course followed. There should be an amendment to the statutes of Ohio, clearly defining the manner of making the contract, and such contract should not be let by competitive bidding.

The costs which enter into street lighting should receive very careful consideration from the company. I am of the opinion that many street lighting contracts are made below actual cost. The following figures are based upon the average cost of a small plant of 100-arc light capacity, taking into consideration cost of construction, maintenance and operation and using the standard enclosed arc system:

I estimate that each lamp will consume 600 watts per hour, and the time of burning 4,000 hours per year, this will make a total consumption of 2,400 kilowatt hours, or 3,217 horsepower hours per lamp per year. Estimating that the average small plant will require 6 lbs. of coal per horsepower, the coal consumption for each lamp would be 9.65 tons, which figured at $2.50 per ton in front of the boilers, would be $24.12. The lamp will have to be trimmed about 50 times, and I estimate the cost of trimming at $1.00. It will consume 50 pairs of carbons, which figure at $2.30. The repairing, time and material would amount to $5.00, cost of installing about $120.00 per lamp, and figuring 10 per cent. depreciation, would amount to $12.00 per year. Cost of labor and salaries would aggregate $12.00 additional and the interest upon the investment $7.20, or a total cost of $63.62 per year. That these figures are certainly low, I would refer to the report of the commission appointed for St. Louis, to investigate the advisability of that city providing its own street lighting system, in which they found that the cost of operating an arc lamp for a city the size of St. Louis, would be approximately near $70.00 per annum.

The writer is inclined to think that the time has arrived to educate the people on the costs of producing electricty, and instead of dealing with a municipality as if you were handling something that was myterious, the factors which enter into such contract should be known and understood by all parties thereto. When it comes, the prices for street lighting will be more equitable and will not be lower than they are now.

BRICK PAVED HIGHWAYS.*

By W. P. Blair, Indianapolis, Ind.

THAT the interest of a manufacturer of a machine or appliance should follow it into the hands of the consumer, that he should instruct and advise as to the manner and method of its use in order to obtain the best possible service, has for years been accepted as perfectly proper. It is conceded that a sensible manufacturer designs his product for public appreciation, and the effort is to produce something that will wear indefinitely or serve its object most perfectly and depend upon increasing popularity in an ever-extending market to absorb the product. The manufacturer who pursues any other course either fails to realize the market 80,000,000 consumers offer, or is attempting commercial suicide.

New and untried articles are generally put out by demonstrators and in recent years several of our largest and most successful manufacturing industries have been built upon the exploits of these so-called experts. The reaper grew into its present state of perfection not in the factory, but out in the wheat field, where representatives of different machines vied with each other to make the record cut under test conditions. Weakness thus exposed was immediately corrected, and in this line we no doubt have the survival of the fittest.

That an article of such common, everyday knowledge as a brick needed any such expert demonstration was doubted by the manufacturer himself, and practically hooted at by the public, but as the public grows wiser it realizes how little it really does know.

Probably one of the first branches of the clay industry which found it necessary to employ experts was the drain tile man, who found himself flooded with complaints that water would not run through his tile, and who generally found that an attempt had been made to run it up hill instead of down, that there had been an attempt to put 8 inches of water through a 6-inch tile, or that the whole trouble arose from an idea that the tile ought to take water through its pores instead of at the joints, and with this in view, a tile so soft had been employed that it was soon dissolved and the flow stopped.

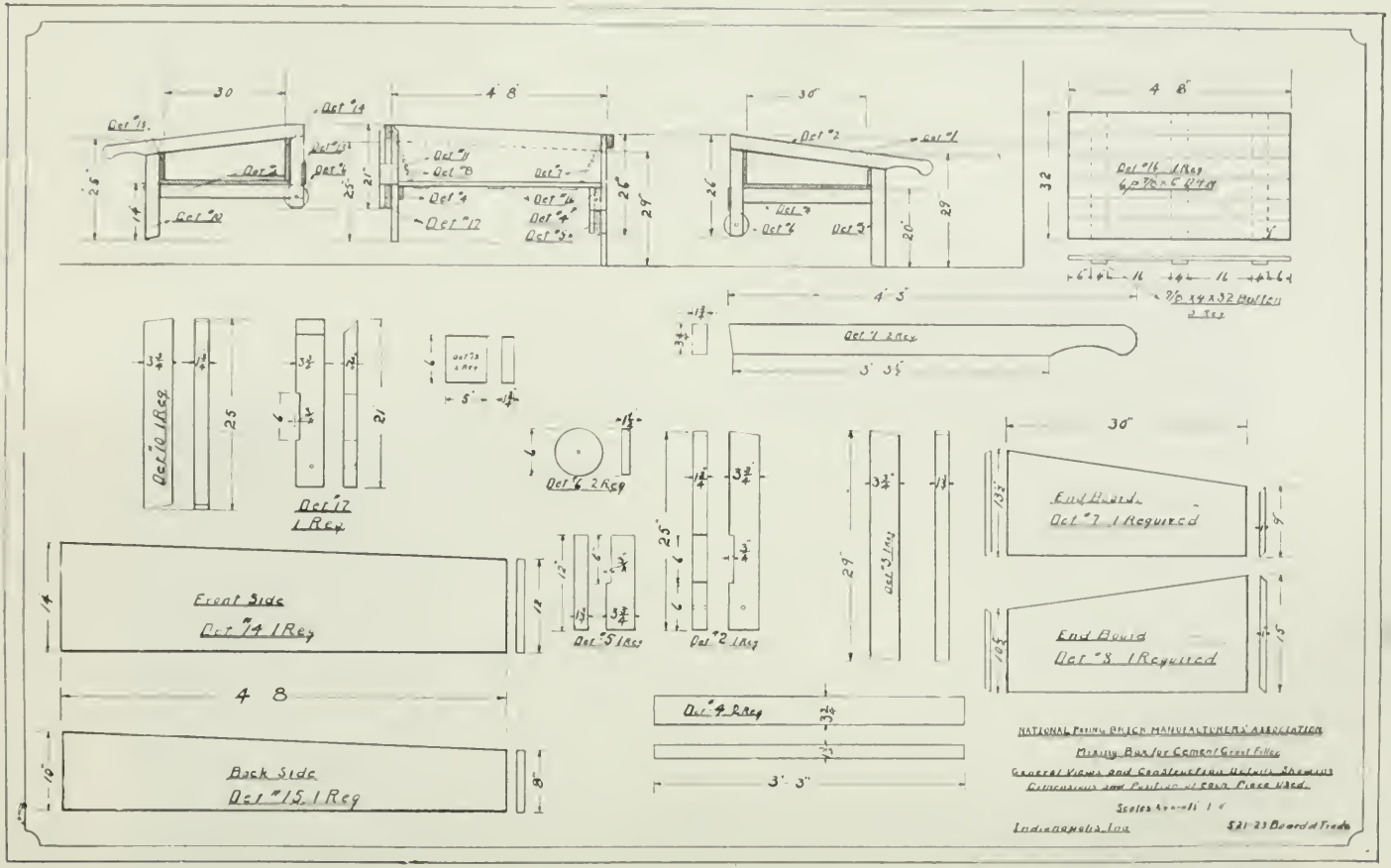
There is perhaps no part of municipal work which has been subject to more experiment than street pavements. There is no part of the work, on the other hand, that is simpler of solution in a way to be satisfactory to the user, economical to the taxpayer, and a credit to an administration. The solution is a brick pavement carefully, properly constructed, in the manner which the manufacturers recommend and which they are endeavoring to impress upon the servants of the public, and which to obtain they are bringing as much influence to bear as is possible to exert through the channels of legitimate advertising and publication for free distribution of text books upon the subject.

The effect of this campaign is to at least occasionally secure a piece of pavement which is an object lesson to the neighboring towns and a stimulus to the business in that community, for, once the merits of a thoroughly good brick pavement become known, the property owners, who pay the bills, insist that no other material be used. In spite of these proven conditions, however, we find an occasional manufacturer who is so indifferent to his own interests that he allows, without expostulation, his material to be used to its greatest disadvantage and refuses to bear his proportion of the expense necessary to an education of the public. Gradually competition closes in around him and his plant is offered for sale, the confidence in his material destroyed at home and its reputation gone in outside markets—simply a result of a short-sighted policy, avoiding responsibility after his product has passed his kiln doors or he has received his money.

The effect of the attitude of the manufacturer of paving brick upon the public is far more serious and far-reaching. Truthful, reliable information upon the subject of paving material in general, and the manner of constructing brick streets in particular, means the saving of thousands of dollars annually to the taxpayer in repairs and maintenance, as well as first cost, and means comfort and satisfaction to all who use the public highways, to say nothing of the cheapened cost of transportation.

Engineering problems have been many and varied during the last past decade. In the designing and building of bridges and edifices of many kinds,

*A paper before the National Brick Manufacturers' Association.



Front Side
Det #14 1 Req
Back Side
Det #15 1 Req
End Board
Det #7 1 Required
End Board
Det #8 1 Required
Det #10 1 Req
Det #17
1 Req
Det #6 2 Req
Det #5 1 Req
Det #2 1 Req
Det #4 2 Req
Det #1 2 Req
Det #16 1 Req
NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION
Mixing Box for Cement Grout Filler
General Views and Construction Details Showing
Dimensions and Position of Each Piece Used.
Indianapolis, Ind.
521-23 Board of Trade

in the building and equipping of steam and electric lines, water works and electric lighting, the skill and ingenuity of the engineers has kept pace with the progress of civilizing advancements. It is a fact, however, inexplicable as it may be, that the designing and construction of vitrified brick roadways, as they have been built for the most part in the last ten years has been a wanton waste of money; viewed from an engineering standpoint, a disgrace to some one and an awful burden upon the taxpayers.

At whose door this responsibility shall be laid, I will not undertake to determine. Interested as I am in the brick business, if I could revolutionize this condition of things I would gladly do so. I believe the engineers of the country can, if they will, so change the practice in building vitrified brick roads that those that are to be built in the future shall be similar in quality to those that are found in such cities as Cleveland and Sandusky, Ohio, and Grand Rapids, Mich. Regardless of the influences that have induced and persuaded brick street building as now obtains, is it not possible to reach such a certain conclusion by reasoning together as will properly direct and cause us to build brick streets at their best?

I have been actually present on few jobs where the sub-grade has been properly and carefully prepared so that it conformed to the grade of the finished street. The sub-grade is often devoid of any proper compression. In most instances, no two consecutive square yards are alike; one square yard may be to grade, but the next one may be I inch below grade, but exactly to grade is a condition not found. (Not infrequently the specifications require the use of a roller so heavy that it is quite impossible to compress the sub-grade at all.)

In the very next step it necessarily follows that a uniform thickness of foundation is impossible. However, the first defect mentioned might be cured to a very considerable extent (by increasing the concrete in depth wherever necessary), but here we are met by the contractor's selfish interest, and it is next to impossible to compel him to put in more than the required depth of concrete foundation that the surface of it may be uniform with the grade of the finished street, and that it be made smooth, for it is absolutely essential in the construction of a brick street that the surface of the concrete foundation be made smooth. Now, what I mean by smooth is, not that it shall be perfectly smooth; rather, that it shall be so nearly smooth that no depression shall be found or elevation permitted exceeding a quarter of an inch above or below the proper grade.

I know that for the engineer to require this condition of surface is often met with a very serious objection. I have had many contractors insist that it is not possible to procure either broken stone or gravel in size or in any proportion of mixture making possible this requirement, and engineers requiring it have been denominated cranks, to my knowledge. Yet concrete foundations have been put in exact accordance with the contract specifying that this shall be done. Without such a prerequisite there is no possibility of using a 2-inch sand cushion upon which the brick are to be laid.

But why a 2-inch sand cushion? And why not a 1-inch sand cushion, as is known to have been called for by the government in one of its navy yard specifications, and under which proposals are to be received within a few days. Why not 1 inch? Simply for the reason that 1 inch will not afford sufficient relief from the vibration formed by the impact of hoof or vehicle upon the street. The suggestion may be made that the brick should be hard and tough enough to withstand the action of the vibration, but not so. Take away all relief and what is the result? With a small tack hammer you may chip and in a very short time the entire brick may be broken away, if it be placed upon an entirely rigid surface.

Why 2 inches? Without undertaking to give you the physical reason, I will simply say that a 2-inch sand cushion does afford the necessary relief to protect the brick against chipping and destruction from the vibration to which it is necessarily subjected.

Why not more than 2 inches? For the very reason that it is impossible to compress exceeding 2 inches to a condition that will afford any support to the load to which it will be subjected incident to ordinary travel.

So the brick must have this necessary relief; they must have the necessary support, in order that the surface of the pavement under constant use, will remain free from depressions; in order, also, that the cement filler with which the interstices are filled be not necessarily subjected to a strain that might shatter, crush or tend to crush such joints. A brick street, to be en-

USING MIXING BOX FOR CEMENT FILLER ON INDIANAPOLIS SPEEDWAY.

tirely satisfactory, must be entirely free from depressions, every part conforming to the grade. This condition must obtain at its construction and remain so during its use, so that the traction resistance shall be at a minimum and the wavy condition avoided. This result must be anticipated in the preparation of the sand cushion, first spread at the estimated depth of 2 inches and these depressions avoided by the use of a hand roller, weighing, say, from three to four hundred pounds; additional sand applied, rolled and screened again, I should say, at least three times. At the last screening it will be found that the uncompressed sand will not be over ¼-inch in depth at any one point. With such a condition it can be readily perceived that when the brick shall have been placed upon such a cushion, no greater compression will follow the use of the roller upon the brick than is necessary to take care of the uneven height of the brick themselves.

It is certain also that in ironing out what few depressions remain and compacting the brick into the cushion, but very little sand will be pushed into the interstices by the final rolling. By this suggested method the grade of the finished street may be conformed to most perfectly. It is often the case that specifications should contain express directions as to manner and method of work; otherwise, it would not be possible to reach results desired. This is particularly so in brick street construction.

The brick should be dropped in straight lines upon the sand cushion, with the best edge of the brick uppermost. Economy for the contractor would require that the brick be brought to and deposited within reach of the person who actually lays the brick in a way that will accommodate his method of dropping them in place, insuring the best edge uppermost. Yet many contractors will insist that dropping them in any way, wrong edge or right edge up, in the street and then paying for the service of a man to turn them over with tongs is an economical method. But, previous to dropping the brick in the street, attention must be given to the necessary provision for expansion cushion next to the curb. It too frequently happens the arrangements for this are improvised without thought as to results.

The board should be prepared by beveling a joint eight (8) inches in width, the thickness determined largely by the width of the street. Even in a narrow street the expansion cushion should not be less than 1 inch; 1¼-inch for a 30-foot street, and 1½-inch for a width exceeding 30 feet. This board should be placed next to the curb, worked slightly into the sand cushion before the brick are laid, and remain until the street is finished in all other respects, after which it should be removed within twenty-four (24) hours following the application of the cement filler. The board beveled and being eight (8) inches in width, it is very easily and rapidly removed, leaving a perfect groove in which to pour the cushion material.

After the brick are dropped into the street the surface should be swept, precaution theretofore exercised that no brick go into the street which are dirty, or, after in, that they are not made so by use, as it is impossible for the cement filler to adhere to a dirty surface. After the sweeping, thorough rolling must take place by the use of a roller not weighing over five (5) tons.

As to the filler, the most difficult problem is to convince the public of the utter worthlessness of all other fillers in comparison with the cement filler, and to bring about a full appreciation of the necessity of the proper application of the cement filler. A cement filler that is mostly cement is too brittle, and one that is less than in proportion of one to one is too weak and soft. The specifications must therefore call for a proportion of one to one, and the necessary skill must be employed to put in place in such proportion; if otherwise, the so-called cement filler is unsatisfactory. Compliance with the simple rules we employ will secure the result, exacting, but easy and economical to follow. Why not follow them rather than the hundreds of different methods that invariably bring a failure?

The filler shall be composed of one part each of clean, sharp sand and Portland cement. The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cement, shall be placed in the box and mixed dry, until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

The sides and edges of the brick should be thoroughly wet before the filler is applied, by being gently sprinkled. From the time the water is applied until the last drop is removed and floated into the joints of the brick pavement, the mixture must be kept in constant motion.

The mixture shall be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be 4 feet 8 inches long, 30 inches wide and 14 inches deep, resting on legs of different lengths, so that the mixtures will readily flow to the lower corner of the box, the bottom of which should be 6 inches above the pavement. This mixture, from the moment it touches the brick, shall be thoroughly swept into the joints.

Two such boxes shall be provided in case the street is 20 feet or less in width; exceeding 20 feet in width, three boxes should be used. (See specifications for making same.)

The work of filling should thus be carried forward in line until an advance of 15 to 20 yards has been made, when the same force and appliance shall be turned back and cover the same space in like manner, except to make the proportions two-thirds Portland cement and one-third sand.

To avoid the possibility of thickening at any point, there should be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, bringing them up flush and full.

After the joints are thus filled flush with the top of the brick and sufficient time for hardening has elapsed, so that the coating of sand will not absorb any moisture from the cement mixture, ½-inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

It is impossible in a paper of this kind to enter into and discuss all the details of construction essential in building of a vitrified brick street at its best. But is not their importance of sufficient interest to command serious attention? In 1909, 8,000,000 square yards of brick pavements were laid in Indiana.

The difference in cost between a good brick street and a bad brick street is so little that it should not be considered. It is true that a matter of one, two or three thousand dollars in the cost of a whole street seems like a saving if a street could be built for less, but considered in connection with the cost of the whole street, which often ranges from forty to one hundred thousand dollars, the advantage to be gained by saving one, two or three thousand dollars is infinitesimal.

As to the difference in actual cost—take, for instance, the foundation, the point wherein a brick street fails more often than in any other respect is that it is put in with a rough and uneven surface, instead of a smooth surface conforming to the grade of the finished street. Now, the increased cost necessary for the contractor to have the foundation smooth can not possibly exceed the cost of one of the roughest character 1 cent a square yard. If, however, this foundation is left in a roughened condition, in all likelihood the real value of the street, both as to its durability and possibilities of its use, decreases fully 50 per cent.

Again, supposing the foundation is made right and a sand cushion of 1 or 1½ inches in thickness, or a sand cushion utilized on which the compression is very uneven, so that it can not be maintained at a uniform 2 inches, in such cases the difference in cost of a sand cushion put in lacking in either quantity or condition can not possibly be accomplished at a saving of more than 1 or 2 cents a square yard less than one exactly and uniformly 2 inches, thoroughly compressed. Yet the want of the uniform 2-inch properly compressed sand cushion insures a percentage loss in the value of the street of more than 50 per cent.

Again, a step upon which depend the highest possibilities of the brick street—the proper rolling of the brick after they are in the street, and the ironing out of any slight depressions found to exist can not possibly differentiate in favor of insufficient and improper rolling exceeding even 1 cent a square yard.

Again, as to the proper application and use of the cement filler, there is no excess of cost either in the use of cement as a filler or its proper application over and above that of an improper application, or the use of some soft, absolutely worthless filler that is often utilized for this purpose at a cost greatly in excess of the cement filler properly applied, the value and satisfaction of which meets every demand.

To sum up, therefore, in actual

money expenditure, the difference in the construction between the good brick street and the bad brick street can not possibly exceed 10 cents a yard, to say nothing of the great advantage to be obtained in the good brick street in meeting every possible requirement of an exacting public in its use, as well as securing the utmost economy by reason of the great durability.

All this is not said by way of complaint. The ability of the engineer is not doubted, but human nature is alike in all professions and in all callings. Indifference toward many things comes alike to all of us—likewise our interest. So our attitude in this whole matter is one of petition. Our attitude is not much different from the little boy who closed his eyes and prayed for a white rabbit, but, on opening them, beheld no white rabbit. He closed his eyes a second time and prayed, with the same result. The third time he prayed vehemently, not even closing his eyes, saying, "Lord, we want that white rabbit, and we want it now!"

THE ELECTRICALLY DRIVEN WATER WORKS PLANT AT MATTOON, ILL.*

By H. W. Clark, Superintendent.

THE water supply of Mattoon is from a sand and gravel stratum, 10 feet in thickness lying 65 feet below the surface, 50 feet of the overlying material being impervious hard pan. The water works were built in 1885, engine house and machinery was located about one-half mile from the principal source of supply, necessitating the building of an auxiliary pumping station where steam was generated for operating a submerged horizontal duplex pump, coupled onto a gang well system of ten tubular wheels. As the water consumption increased other tubular wells were made and such were pumped with direct acting vertical steam heads, the steam for same being piped from the boiler at plant, a distance of 300 feet, and finally as other extensions were made, carried a distance of 900 feet to supply these newly acquired wells. To further keep pace with the steadily increasing demands for water, after carrying steam by pipe line to the practical limit in distance, isolated, independent pumping stations were installed, three in number, each operating steam pumping heads.

It can be readily seen that this plan of operation was quite expensive, bringing up the cost per thousand gallons of water pumped, quite high.

After consideration of the various contemplated modes of operation from a central station; comparing the costs of power from compressed air with that from electricity, and carefully considering the costs of installation, and comparative losses in transmission, the writer favored electrical installation and started an investigation, in the fall and winter of 1904, of the successes of other electrical pumping stations, hoping to profit by the experience of other water works managements. I was greatly surprised at the very few plants found using electricity for pumping water, and was obliged to install this plant almost wholly along new lines.

Our wells which we wished to electrically equip consisted of nine in number (scattered over a territory of a radius of one-half mile, the center of power being about one-third mile from the central station.)

These wells are of tubular construction, 10 inches in diameter, 65 feet deep, each fitted with a Cook strainer 10 feet in length, surrounded by sand and gravel stratum. A six-inch drop line extending down inside of the 10-inch casing to bottom of strainer, contains brass working barrel of pump. On top of 10-inch casing and securely fastened thereto is the pumping head, the top of 10-inch casing being hermetically sealed, entirely independent from the drop suction line, there being properly fitted thereto vacuum gauge and pressure gauge with valves for operation to clean out strainer by back pressure of water, steam or air.

Owing to existing conditions at our plant, it was desirable to pump our

*A paper before the Missouri Electric, Gas, Street Railway and Water Works Association.

supply first from the wells into a large enclosed receiving reservoir then in use at our main pumping station and from there into our stand-pipe and distributing system, thus pumping the water twice, provided such could be done without additional expense over single pumping.

In the installation of this plant we did not lose sight of the factor of reliability and dependable service at all times, the importance of which is well known to every water works manager furnishing water to a community for fire protection.

Our requirement in a power plant for our regular service was about 75 h. p., with necessary reserve for emergency and fire purposes.

Our old boilers (two 65 h. p.) with a working pressure of 80 lbs. were thrown out and replaced by two high-pressure boilers of 125 h. p. each for a working pressure of 150 lbs. Our two old horizontal domestic service and fire pumps of a capacity of 1,000,000 gallons each were retained for reserve fire service.

Our new machinery installation consists of two high-speed tandem compound engines, each directly connected onto Western Electric generators. These units are rights and lefts and set side by side, and so arranged that the shafts of units may be coupled together in a continuous line and either engine may run either generator. The belt wheel on each engine adjoins and is a part of the shaft coupling, and a single belt is run off of either of these wheels and over a double width pully of a Holyoke Dean double acting triplex pump of 1,000,000 gallons capacity. The engine and generator units are of different sizes, one larger than the other; the smaller unit being for our present consumption, and the larger for reserve purposes, with a view of reversing plan of operation when the increased load becomes too great for the smaller unit, thus being able at all times to run our operating plant well up to its rated capacity, securing the greatest economy thereby.

Our smaller power unit comprises engine of size 8 inches by 13 inches, tandem compound, rated at 90 h. p.; the direct connected generator, 50 k. w. The larger unit is engine of size 9 inches by 16 inches by 12 inches, tandem compound, rated at 110 h. p., and direct connected generator, 75 k. w. The engine speed is 290 r. p. m., working steam pressure 140 lbs. The current is 550 volt d. c.

These units generate current for operating our motor driven pumps, pumping from wells into storage reservoir heads (9 in number delivering water) and they also operate the triplex power pump which takes the water from storage reservoir and delivers it into standpipe and distributing system. This pump is designed to handle approximately the same quantity of water that is being delivered by the motor driven pumps, and while our entire supply is pumped twice, our operating cost is less than if all the water was pumped directly from the wells into the distributing system, as there is less loss in transmission of current, only about one-half the current being distributed as where single pumping is done. Other savings are made, as in the reduced wear and tear of machinery owing to reduced load. Also, with this system there is secured the advantage of viewing the flow of water as it is discharged from wells into storage reservoir, this being a partial check on the efficiency of the motor driven pumps.

These units also furnish light, both arc and incandescent for the entire plant.

Our well equipments consist of 8 low service installations (the pumps delivering water into the storage reservoir above described under a low head) and one high service installation, this pump delivering water into the mains under domestic and fire pressure. Five of our low service plants are equipped with Downie single acting pumping heads fitted with special balancing or equalizing attachments, driven by 7 h. p. Western Electric motors, directly connected with rawhide pinions. The other three low service plants are equipped with Luitweiler double action pumping heads driven by 7 h. p. motor directly connected with rawhide pinions.

Our high service plant is equipped with a Luitweiler double acting pumping head driven by Western Electric motor, 10 h. p. This plant operates regularly under a discharge head of approximately 50 lbs. pressure, and in time of emergency under a fire pressure of 80 lbs.

The electrically operated wells are each covered by a brick and concrete house, and each house is connected by private telephone to the central station, so that motor attendant may be in communication at all times with the power plant.

The switchboard at the central station is equipped with the usual electrical instruments, comprising volt meter, ammeters, circuit breakers,

switches, etc. From the ammeter indicator, the engineer can instantly detect the stoppage of any motor. As a pilot for the guidance of motor attendant there is placed on top of each pump house a finial attached to a rod, extending through roof of house and connecting onto the pumping head. This finial is in constant motion when pump is running.

As a night pilot, a light burns in front of each house during operation of pump. The stopping of machinery extinguishes light. The throwing of a double pole, double throw switch, cuts in the light without starting machine.

These arrangements enable the motor attendant to readily locate any stopped machine, without making a trip to all.

This plant has been in operation since the fall of 1905. In efficiency it has far exceeded the writer's calculations and expectations.

The operating labor has been reduced from 13 men to 3 men, and the coal consumption has been cut more than one-half.

The plant has proven to be perfectly reliable and absolutely dependable at all times (very much more so than the old plant.) There has never been one moment of time since the building of this electrical plant that same was crippled in any way so as to interfere with the furnishing of a plenty of good water for domestic and fire purposes.

THE CHARTER OF INDIANAPOLIS.*

By Caleb S. Denny, Ex-Mayor.

TWENTY years ago, when I was mayor for the first time, Indianapolis had a patchwork charter, or rather a mere collection of laws, very different from the present charter. There was a common council and a board of aldermen, and committees from these practically controlled the city. The mayor had a little executive power and was also judge of the police court. But committees of the council appointed the police, fire and street officials, city attorney, etc.

That condition so unfavorably impressed our business people that they made up their minds to change it. In 1891 a new charter was adopted, which in 1905 was superseded by a general charter law for the State. Under it the so-called "federal system" of Indianapolis was adopted and applied to all cities of the first to the fifth class. Indianapolis is and will long remain the only city of the first class, and her charter comes nearer to embodying the federal plan than any other city in the country; and Indiana is the foremost state in giving this plan to all cities and towns in the state. In my opinion this plan is the only proper one, concentrating as it does great power and responsibility in the mayor, and keeping the executive, legislative and judicial branches independent of each other.

Under this system the most important branch of the city government is the executive. The mayor is in almost absolute control, and on him is thrown almost all the responsibility. Aside from the council, there are only three officers elected by the people: the mayor, the clerk and the police judge, all for four years. The mayor appoints all other important officers, including four boards, and does not have to submit his appointments to the councils. He appoints the three members of the Board of Public Works (only two being of the same political party), the two members of the Board of Public Safety, Board of Health (two), Park Commission (four); he also appoints the Controller, Corporation Counsel (City Attorney), and the City Engineer. His boards appoint (usually with his knowledge and consent) their own subordinates.

The judicial department is entirely independent of the mayor.

So also is the legislative department, though not so distinctly, for there are some connections between the council, mayor, and, for instance, the Board of Public Works, which have concurrent power in granting franchises to and entering into contracts with public utilities corporations.

Also the council may act concurrently with a board, as where the Board of Public Works begins improvements against which affected property owners file a protest, the council by a two-thirds vote may intervene, override the protest and

*From an address before the Los Angeles City Club.

cause the improvement to proceed.

In general, however, the executive, legislative and judicial branches are independent.

The council has as its chief function the levy of taxes and appropriation of funds. Last winter a radical change was made in the council. Previously it had twenty-one members—one from each ward and six at large. Since the change it has but nine members.

The process of nomination is peculiar and includes the nomination by each political party at the primaries (which are party primaries, pure and simple) of a candidate for councilman for each of the city's six "districts." But all the voters throughout the city vote for nine men. This means that there are six Democratic nominees, six Republicans, and so on; six nominees for each party; one from each district, but all are candidates-at-large. Now when a Republican (for instance) has voted for the six Republican nominees (as the average partisan voters would do) there are three more candidates to vote for. So he selects, from another party, or other parties, the seventh, eighth and ninth of his choice.

You can readily see two unusual features of the council elected under this law. One is that it is possible for some district to be left without a representative—possibly, but not probably; and even if it turned out so, the at-large feature would prevent any unfairness. The other feature is that the council cannot by any chance be composed exclusively of members of a single political party; there are bound to be at least three of the party not in power in the city, and possibly more than three. This is the chief novel feature of the council.

Now as to the mayor. People are likely to say that he has too much power and too much responsibility. It is likely to seem so to the mayor, too. I, for one, felt the responsibility very seriously, under the charter of 1891. The mayor is not only responsible for the acts of the four boards before mentioned, but for all the appointees of those boards. It is not a plan universally approved, but I believe it to be the only correct one in this age of great public works.

It means that when a man is elected mayor, all he has to do to keep out of trouble and be successful is to appoint honest and capable men on his boards. If perchance anything goes wrong in spite of all his care, it is the easiest thing in the world for the mayor to obtain the public's pardon by discharging the man or men who have failed. I was one of those obliged to do that; I requested the resignation of a board and appointed another board in its place. That the mayor has absolute power to remove, is the strong point of the federal system and the success of the plan. It sounds dangerous, but it is the reverse and is a good plan for a progressive city.

As to public improvements conducted by the Board of Public Works. The charter of 1905 provides that where a street (for instance) is to be improved, and an assessment district therefor is established, if anyone is dissatisfied with his assessment he has a right to apeal from the levy to the court. That is, he could file a complaint against the city. The court would immediately appoint three appraisers, who within three days would report to the court the amount of benefit which would result to the plaintiff. If the appraisement fell 10 per cent. or more below that of the Board of Public Works, the court would award to the plaintiff a reduction of his assessment and the city would have to pay the difference between the original assessment and the one fixed by the court. This law was upheld by the supreme court. Under it a case is tried as any other issue is tried, the court deciding on the evidence.

But there is very little tedious litigation arising out of improvements by the Board of Public Works. The proceedings of the board are, furthermore, the most expeditious imaginable, and one feature is especially commendable. The board can start, carry through and finish an improvement all within two months, notwithstanding any opposition of property owners. The work goes on in spite of protests, and the protest also may go on (by suit brought in court as already described) at the same time. The protesting property owners are awarded damages (if really damaged or excessively assessed) but they can not tie up the improvement proceedings.

After a careful study of the federal system of municipal government, I have tried to sketch for you. I made up my mind a few weeks ago that another improvement can be made in it—at least as applied to Indianapolis and the county of Marion. I commend the improvement to you here also in case you ever wish to discuss a city-and-county government.

Indianapolis covers more than a township; it covers and contains about nine-tenths of the county's population, and more than nine-tenths of the assessed valuation. Therefore I think there is no sense in continuing two separate governments.

The federal system can be applied to both the city and county just as well under one set of officers as under two. The two together can be better conducted by even a smaller number of officials than the city alone has today—better and much more economically. I know it can be done in Indianapolis and Marion county. I believe it can be done here.

There is no provision in Indianapolis for the initiative, referendum or recall, though they were discussed and strongly urged. The only provision in the charter for removing an official is by impeachment—a harder system to make effective than yours here. The recall would work well with the federal system.

SOME EXPERIMENTS ON THE DURABILITY OF CEMENT DRAIN TILE.*

By Prof. W. H. Day, Agricultural College, Guelph, Ont.

SINCE the Ontario Agricultural College began college extension work on the subject of farm drainage some five years ago there have been numerous inquiries for information on the subject of cement tile. People usually wanted to know two things: first, whether the cement tile could be made cheaper than the clay tile, and second, whether they would be durable. When these inquiries first began to come in there were not, so far as I am aware, any extensive or conclusive data as to the durability of cement drain tile, nor was there any grave question about their durability. There was a general impression, however, that they should prove durable, judging from the manifold conditions in which concrete had proven its usefulness.

In the latter part of the year we learned of the controversy over the durability of the cement drain tile, and we must confess that the idea of cement being soluble was a new one to us. After reading the attack on cement and the answer to it we counselled our farmers to go slowly in the adoption of cement tile, believing that the uncertainty in our own minds at least about their durability was sufficient to warrant such action. At the same time, however, we decided to conduct some tests in order to learn for ourselves something about the solubility of cement, and to deduce from the information thus obtained some idea of the probable durability of cement tile. Those experiments were begun in February, 1909, and have been continued until the present time. Besides the points already mentioned, the porosity of cement tile received some attention during our experiments.

Experiment I.—Sample, a piece of tile weighing 43.256 grams, after being dried to constant weight at 215 degrees F. This tile was made by the "dry process" in April, 1908, in proportions 6 of sand to 1 of cement. For a few days after being made it was watered daily, and then it was submerged in water for a period of six weeks, after which it was removed and transferred to a storage cellar, where it remained until solubility experiments began. Tile quite porous. After the small piece had been dried to constant weight it was placed in distilled water for four days, then removed, dried, weighed, and again placed in fresh distilled water. As convenience allowed it was dried, again weighed, and once more placed in fresh distilled water. This was repeated 16 times, the total period of solution being 148 days and the total loss in that time was 0.113 grams. The total cement in the sample was 7.174 grams, hence at this rate the cement would all dissolve in 27.7 years. The experiment was next performed with water from the artesian wells at the college. This water is high in total solids, about 460 to 480 parts per million, made up chiefly of bicarbonate of calcium, bicarbonate of magnesium, or the compound bicarbonate of calcium and magnesium. There is also a small amount of chlorine in it. The sample was tested five times in this water, the total period of solution being 47 days and the total loss in weight .090 grams. At this rate it would take only 10 years to dissolve all the cement in the sample.

*A paper before the Canadian Cement and Concrete Association.

Experiment II.—Sample, a piece of tile, proportion 6 to 1, made on London two-piece machine May, 1908, watered daily for a week after making, stored in cellar till November, 1909, mixed much wetter than sample used in experiment 1, so wet, indeed, that the molds would not clean well. Dry weight 43.213 grams. The treatment was the same as in experiment 1, only the number of tests in distilled water numbered 8 instead of 16, the total period in the water being 73 days. During the period the sample lost .025 grams, at which rate it would take 57.4 years to dissolve all the cement in it. When put in the well water the loss in 47 days was .090 grams, which rate would use up all the cement in 10.3 years.

Experiment III.—Sample, a piece of wet mixed tile, made the same time as No. 2 and watered and stored in the same way. Dry weight 36.2795 grams. Treatment, distilled water for 73 days, well water for 47 days. This sample lost only slightly in distilled water and gained .0333 grams in well water. At this rate it would last forever.

Experiment IV.—Sample, a piece of tile, proportions 4 of sand to 1 of cement, made by Mr. George Holden, of St. Marys, on the London Automatic cement tile machine. Watered daily for a week after being made, and then stored in our laboratory until October, 1909. Dry weight 20.4792 grams. Treatment, same as II and III. Loss in distilled water in 73 days=.0387 grams. At this rate the sample would last 26.5 years.

Experiment V.—Sample, a piece of tile, proportions 4 of sand to 1 of cement, made by same maker as No. II, cured and stored in the same way. Dry weight 35.781 grams. Treatment, same as others. In 73 days in distilled water the loss was .0175 grams, at which rate the sample would last 102.2 years. In 47 days in well water the sample gained .0165 grams in weight, and thus would never disintegrate.

Experiment VI.—Sample, a piece of clay tile, about average quality, possibly burned a little slack. Dry weight 36.660 grams. Treatment in distilled water 48 days, weighed 5 times, in well water 47 days, weighed 5 times. Loss in distilled water 1.159 grams, at which rate the sample would last only 9.1 years. Loss in well water .081 grams, at which rate the sample would last 58.3 years.

In estimating the time that sample would last it has been assumed that they would be subject to solution 365 days in the year and that the rate of solution would be uniform. The first of these conditions certainly would not hold in practice. During a large portion of the year, possibly half, tiles are dry and not subject to solution, and consequently would last twice as long as the periods mentioned, provided the rate of solution during the other half of the year was constant.

We had hoped to establish something definite as to the rate of solution, but we have failed to do so yet. The rate of solution seems to fluctuate with some factor other than time, probably temperature. Just when our curve for rate of solution would reach a constant for two or three readings, this variation would occur and prevent conclusions. In all samples the rate of solution in distilled water appeared to fall off, slowly in most cases, but very rapidly in a few, especially in the case of the clay tile. When placed in the well water the samples all behaved irregularly at first, giving either large losses or else large gains, and these losses or gains fell off rapidly.

Three other experiments were performed which probably come nearer natural conditions than the previous experiments do. Three half tiles were placed in water on May 6, 1909, where they have been ever since. At the end of six months they were dried, weighed, replaced in the water. Then last week they were dried and weighed again. The results are as follows:

Experiment VII.—Sample, a half tile, proportion 6 to 1, made on London two-piece machine, dry process, May, 1908, watered for a week, stored in cellar. Dry weight 1797.5 grams. Treatment, in running well water for 10½ months, weighed at 6 months and at 10½ months. Result, tile gained in weight each time. Total gain 3.4 grams.

Experiment VIII.—Sample, same as in 7. Dry weight 1910.25 grams. Treatment, same as 7. No change in weight in first 6 months, a gain of 4.05 grams in next 4½ months.

Thus these two samples would never disintegrate at this rate.

Experiment IX.—Sample, a half tile, proportions 6 to 1, made on London two-piece machine, made very wet, so much so, indeed, that tile would not hold shape, and molds would not clean. Allowed to dry, getting a few showers of rain, and then stored in cellar. Dry weight 2001.0 grams. Treatment, same as in 7 and 8. Tile lost 1.90 grams first 6 months and 2.7

grams next 4½ months. At this rate the sample would last 63.4 years.

It is worthy of note with regard to these three samples that those made by the dry process, and therefore very porous, were the ones to gain in weight, while that made by the wet was the one to lose.

The behavior of these three large samples contrasts so strangely with that of the small samples as to indicate that experiments with small pieces are apt to be very far from actual conditions. For instance, the rate of solution for the piece of clay tile would indicate that that sample would all dissolve in less than two generations. And in much less time than that the tile would be so weak as to give way under soil conditions. Experience has shown that such does not occur, and hence we must conclude that the conditions are so artificial that it is not safe to base arguments as to durability upon such tests. It is even doubtful whether the large tile in running well water is very close to natural conditions. In the soil there will be much very fine sediment in the form of clay and colloid particles to lodge in the pores and prevent solution. The process of accretion shown in two out of three of these large samples would doubtless be much more rapid in the soil. Another reason for the slower solution in the large samples was the cooler temperature maintained by the constant introduction of cold water. Basing our conclusions on these larger samples we are not able to see any danger of the cement tile crumbling.

Porosity.—With regard to the porosity we find that it varies with the proportions of cement, with kind of sand used, and also with the method of making. The more cement used, the finer the sand, or the wetter the mix, the less porous the tile. But even the most compact ones tested were much more porous than clay tile.

RELATIVE EFFICIENCY OF DAY LABOR AND CONTRACT SYSTEMS OF DOING MUNICIPAL WORK.*

By Charles R. Gow, Boston, Mass.

IN the first place, the rate of wages paid for foremen and superintendents in municipal and most government work, is as a rule, I think, less than is paid by the large contracting concerns doing the same work on the same scale, and that would mean, of course, that a much less efficient class of foremen would be carried by the cities than by the contractors. We have found from experience that some foremen are cheap at $10 a day, while others who might be willing to work at from $2.50 to $3 a day, would be very expensive. As an illustration, I once worked as superintendent of a large contracting concern in New York. They had previously done railroad work, and they were engaged at the time on the construction of one of the large subway sections there, and brought on a lot of these foremen to handle that work. And the first criticism I made after looking over the work was that they did not have a sufficient number of competent and experienced foremen. I was told to hire any foremen I knew who were suitable for the work, but when I mentioned the fact that we should probably have to pay $150 a month for such foremen as I had in mind, the president of the company threw up his hands. After considerable argument he finally agreed to allow me to engage two such men as I wanted at that salary. The first of these men who happened to appear on the work was put in the place of a $3 man. And his first act was to discharge six men out of the gang, and in his first day's work the result was an increase in output of 25 per cent. And this increase in output, as I remember it, represented a value of something like $35 to the contractor. That would illustrate in a way what I mean when I say that the high-priced foreman is oftentimes cheap in the end.

The cities, of course, establish a fixed rate for their foremen as a rule. There is no promotion by merit, and there are seldom any questions asked as to the ability of the foreman, provided he comes with the proper credentials from the civil service or other department. Of course, the average laborer will do no more work than he

*A discussion of H. P. Eddy's paper before the Boston Society of Civil Engineers, similar to the one on p. 76 of the February number of MUNICIPAL ENGINEERING.

is required to do, whether he is working for the city or for a contractor. And unless he has competent supervision the results cannot be expected from him. The political aspect of city labor was pretty clearly dealt with by Mr. Eddy. Of course, its demoralizing effect is unquestioned. It was in order to correct the evils of political control that the civil service system was inaugurated, and yet to my mind that is even a greater evil as regards labor in efficiency than political control. When, some years ago, I was acting as superintendent for the Boston Transit Commission, in charge of their contract labor, we had some six hundred men employed. That was on the original subway, doing some special work where it was adjacent to buildings, or in localities where it was feared the contractors might lead the commission into difficulties. We were obliged under the law to procure all the labor from the civil service list. And the most difficult feature of the whole undertaking was to secure a gang of men that we could do anything with at all. The trouble seems to come in this way. The good men, the efficient men, are seldom out of work for any great length of time. The value of their services is well recognized by contractors, and as soon as they finish up one job they secure other work, if there is work being done. Consequently they don't take the trouble to register with the civil service commission and wait their turn before they are certified for employment. The majority of the men who do register with the civil service commission are men who can't find employment in any other way and simply look upon the city as a good asylum from which to obtain an easy living. The result, as we found it, was that if we wanted 25 men to start a piece of work, we would make requisition for 100, and out of that 100 probably 50 would appear with high standing collars and patent leather shoes, and some of them on crutches or otherwise disabled. And we would be expected to select from that crowd a gang of men to go down 25 or 30 feet below the surface of the ground to brace trenches and excavate in wet and difficult ground. I can readily understand where the city departments may be seriously handicapped on that account and where a really conscientious official would have serious difficulty in obtaining a gang of men that would be suitable for his needs.

The next evil that suggests itself is the influence of labor unions. The labor vote, of course, is of such consequence that it can't be ignored by political officeholders if they expect to continue in office. And the result is that labor councils have been allowed wide latitude in dictating the details of labor administration. It is one of the avowed principles of the labor unions at the present time to so regulate the output of men as to make positions for the largest number of men possible. And they consider it perfectly legitimate to so cut down the output of one man as to make room for a second one doing the same work. Of course where this is allowed to prevail, as I believe it is largely in the city employ, it can't be expected that efficient service can be maintained.

Then there is the question of discharging men in the city employ. Now that they are under the protection of the civil service, it has become a matter of considerable difficulty for a foreman to get rid of an inefficient man. And I can readily see where all these things combined can tend to raise the price, as Mr. Eddy has shown. The matter of employing citizen labor is very fine in sentiment, but it hardly makes for economy. The contractors found long ago that the available supply of English-speaking labor was practically exhausted, that is, the supply of competent labor. And they were obliged to turn to foreign labor, not so much as a matter of economy, as a matter of necessity. My own experience is that we pay practically the same rates of wages to the competent foreigners that we do to equally competent Irishmen or Americans. And while we would much prefer to have the English-speaking man to the foreigner, we find it impossible to obtain a sufficient number of competent men. And, as a matter of fact, the Italian labor at the present time is becoming scarce. The better class of Italian laborers today can command and receive $2 a day, when business is good, for common labor. We pay some of them who are skilled a little beyond the average as high as $3 a day. We pay a minimum wage in our company of 17½ cents an hour, and an average for common labor of probably about $2.10, which is not a serious handicap to day labor as a matter of competition.

I am inclined to take issue with Mr. Eddy as to the possibility of day work being done better than contract work. My experience and observation lead me to a different conclusion. I have noticed that where day labor is in

vogue, as a rule there is no inspection, and where there is any conscientious endeavor to do the work cheaply, it is carried to the same extreme that a contractor is apt to carry his work in doing it cheaply. I have in mind an instance I noticed a few years ago in one of the cities nearby where bids were asked for the construction of a covered waterway, a brook channel, I think it was. And for some reason all the bids were rejected and the work was done by day labor. In that case there was an inspector on the work who appeared to me to be a little more ambitious to hustle the work along and to do it cheaply than even the foreman himself. Most of his energies were given to pushing the work. On that particular piece of work there was a concrete arch, very flat, as I remember it, and not more than 12 inches in thickness. And at the time I noticed the work they were concreting this arch and imbedding in it field stone as thick as they could get them and still have them come within the limits of the sections. Now, so far as I know, no serious trouble has occurred from that type of construction, but I rather imagine that if a contractor suggested that to an inspector or an engineer he would be told a few things. There are several other cases I have in mind where contracts have been called off and bids rejected and the work subsequently done by day labor and the engineers or inspectors, having the contract price which they must not exceed, have stretched their consciences materially to keep within the limits under the disadvantageous conditions they were put to by the labor situation and expense.

As a general thing, in letting contracts, the disadvantages that Mr. Eddy referred to, and which I admit are considerable, could largely be overcome if the engineers would show a little more courage oftentimes in rejecting low bids and the bids of incompetent parties, and insist, as far as they are able to do so, on awarding the work to competent parties at what would be a fair and living price. We all of us make mistakes in our bids. We often overlook important items. You understand, of course, that the working engineer has had months, perhaps, to think over the problem and to think over the obstacles and the difficulties to be encountered, while the contractor is obliged to form his judgment in a few days, and oftentimes the best of contractors make serious mistakes in estimating the work, and consequently bid ridiculously low. Of course, there is a certain spirit among contractors as well as other business men that makes them feel like standing up and taking their medicine under such circumstances. And oftentimes they would appreciate a suggestion from the engineer that he would like to have them retire under the circumstances and allow him to award the contract to a higher bidder. It is not impossible to find out by a proper investigation just what the ability of the contractor is and whether the work in question is beyond the limit of his ability. It seems to me that it would be perfectly proper, and should almost be deemed necessary under the circumstances I have outlined, to advise the awarding of the bid to some other contractor. And if this were done in all cases I think that the difficulties that arise out of contract work in some cases could be largely overcome.

The question of day-labor versus contract work will probably never be entirely settled. It is probably generally admitted that day-work must cost more than contract work. But there is a question whether or not, in a certain measure, the public does not wish to accept the conditions as a concession to policy and sentiment, provided the difference is not excessive.

VALUATION OF WATER WORKS SYSTEM OF RICHMOND, IND.*

By Howard A. Dill, Engineer and Superintendent.

IN presenting the subject covered by this paper, it is necessary to give a brief history of the Richmond plant. This company was incorporated in 1883, with a capital stock of $250,000.00. A franchise was granted by the city, and a contract made for seven years covering hydrant rental. The plant was put in operation in 1885 and carried a bonded indebtedness of $200,000.00. On Sept. 21, 1892, a new contract was made for

*From a paper before the Indiana Sanitary and Water Supply Association.

twenty years. The plant in 1885 comprised a brick pumping station, two and one-half miles from the center of the city, containing a four-million Holly pump, two 80 horse-power boilers and necessary piping; a ten-million-gallon reservoir with bouldered inner slopes, located one mile beyond the pumping station; a twenty-inch main connecting the reservoir and pumping station; an infiltration gallery 300 feet in length; a twenty-inch main to the city, and a distribution system with twenty miles of mains from six to sixteen inches in diameter, 170 Mathews hydrants with six-inch branches and about eighty valves. Since the installation of the system in 1885, three additional galleries have been built, aggregating 1,225 feet in length, and a sixteen-inch cast iron siphon line three miles in length conveys water to the pumping station from a large dug well. Another Holly pump of six million gallons capacity was installed in 1894 and two boilers added. The reservoir has had the bottom and inner slopes cemented, and the distribution system has been gradually extended. All parts of the plant have been kept in good condition, and Mr. Dabney H. Maury, who was recently engaged by the city, reported that "the plant as it now stands is in almost every respect above the average for cities the size of Richmond." Its present length of mains is 37.34 miles of cast iron pipe from 3 to 20 inches, and three miles of wrought iron pipe from ¾ to 3 inches diameter. This does not include 4,713 feet of 20-inch pipe from pumping station to reservoir. On July 1. 1909, there were 312 Mathews hydrants, 2,360 meters, 4,281 service attachments in use, 23 fire lines and 112 free services for supplying water to school buildings, hose houses, drinking fountains, flush tanks, etc. The consumption for the year, same date, was 778,000,000 gallons, of which 351,000,000 gallons were metered. The estimated free water was 60,000 gallons for the year.

In March, 1908, a fire occurred in a downtown business block, originating in a large stock of paint, and after several hours' work, was gotten under control with a loss of $60,000.00. Thirteen streams were used under direct pressure. As a result of this fire, the Commercial Club took up the matter of additional fire protection, covering a second main, another pumping engine, an additional hose company, more fire apparatus and a building code, following very closely the requirements of the State Fire Inspection Bureau's conditions, by which Richmond could be placed in Class 2.

A conference was arranged between the Board of Public Works and the company, and a proposition was made by the latter to cover above requirements, provided a new contract was entered into, the rates therein to be practically as heretofore. The Board of Works considered the proposition unsatisfactory, and decided to employ an expert engineer to review the situation. Mr. Maury, of Peoria, Illinois, was engaged by the city, and the company retained Mr. John W. Alvord, of Chicago. The city desired the company to give it such data as would enable it to obtain the value of the plant. Being confident that the city was acting in good faith, and wishing to convince a doubtful public that it was not seeking a return on an inflated stock and bond issue, the company opened its books for examination by the city's accountant. The action of the company met with hearty approval, and it was agreed that the engineers should work in conjunction in securing the inventory of the plant. There could then be no dispute on the items of facts. Any differences arising would be on valuation only. The preliminary work of the engineers consisted principally in checking and tabulating the data furnished by the maps, records and inventories of the company. Information as to character of excavation, street pavements, etc., was obtained from the city engineer. The work of the accountant consisted in reviewing and auditing the receipts and expenditures from 1904 to 1909, and in examining the investment or plant account from date of organization, to see if the entries therein were properly charged to such account. The company has always been conservative in entering up the cost improvements on the plant account, and depreciation has been taken care of by charging repairs and replacements to the repair account. Under this system the books of the company on July 1, 1909, showed a plant valued at $553,331.20.

The report of Mr. Maury was made to the Board of Works in November, 1909, and included a complete inventory of the plant, valuation of same, report of the expert accountant, and recommendations for betterments. In determining the present value of the plant, Mr. Maury and Mr. Alvord took into consideration the cost of reproducing the property, which plan seems to be growing in favor as a most equitable one. Two years were estimated

as necessary to complete the new plant, and two more years to secure a revenue equal to that acquired by the existing plant at the expiration of the same period. Under this method, the cost of reproduction of the physical property is given as follows in Mr. Maury's report:

Description.	Cost of Reproduction.	Depreciation.	Present Worth.
Preliminary costs	$10,000.00	$1,088.00	$8,912.00
Real property, water rights and rights of way	37,400.00	.....	37,400.00
Interest on real property, etc., during 1½ years' construction	2,805.00	.....	2,805.00
The distribution system	328,436.39	27,094.12	301,342.27
The reservoir	50,508.44	3,737.62	46,770.82
Pumping station	65,517.55	13,956.12	51,561.43
The water supply	73,618.87	9,581.97	64,036.90
Meters, stock tools and other property	42,348.89	7,564.29	34,784.60
Engineering 1½ years' construction	30,531.76	3,150.88	27,380.88
Interest during construction	24,418.76	2,520.02	21,898.74
Cost of reproducing the property	$665,585.66	$68,693.02	$596,892.64
Going concern value	110,825.69	.....	110,825.69
Operating capital	10,000.00	.....	10,000.00
Total cost of reproduction	$786,411.35	$68,693.02	$717,718.33

Mr. Maury's recommendations for betterments cover a new pump, suction well, increase of water supply, a 20-inch main to the city, additional mains to improve circulation, and additional valves and hydrants, the total being estimated at $139,000.00. Mr. Maury estimates that the present net earnings would yield 8.34 per cent on the physical value of the plant, 6.94 on the valuation, including going concern value, and 5.18 per cent on $857,188.33, which includes the above physical and going concern values, and the amount invested for betterments as recommended.

As the Board of Works, to whom the report was submitted in November, was to retire January 1, 1910, no action was taken, except to make a report to City Council, in which it highly commended Mr. Maury for his excellent report, but took exception to the going concern value and charges for depreciation.

The report of the Board of Works claimed that as the contract of the company expires in 1912, there should be little, if any, allowance made of the plant as a going concern. Some confusion seems to have existed between good will and going concern value. Even if all rights of the present company ceased at any definite period, the going concern value would still exist, for if the city undertook to reproduce the property, it would sustain a loss in revenue estimated by Mr. Maury and Mr. Alvord as $110,825.69 before the new plant acquired a business equal to that of the existing plant. Legal decisions warrant such a valuation.

Many of the most eminent hydraulic engineers include such values in their estimates. Mr. Benezette Williams says: "Going value is inherent in the plant, and is a part of it just as truly as the cost of machinery and pipes is a part." The Wisconsin Utility Commission says: "The courts have almost universally held that this element is an important and valuable consideration, which cannot be left out of account in fixing the fair value of the property of a public service corporation devoted to the public service."

The Board of Works, in commenting upon the estimate of depreciation, contended that as the ordinary average annual rate of depreciation on waterworks plants, taken as a whole, is about 2½ per cent, the same per cent should be applied in this case, and, figuring the average investment for the twenty-four years of the company's existence as $500,000.00, determined the depreciation July 1, 1909, as being $300,000.00. And yet the plant is regarded as one of the best of its size. I assure you, gentlemen, that it is still very far from being ready for the junk heap.

What will be the outcome of the investigation, the writer cannot state, but it is certain that the friendly action of the city and the company has greatly improved the situation locally, and whether the city purchases the plant, or enters into a new contract, it is certain that the recent valuation has facilitated the adjustment of any differences that may have existed.

EDITORIAL COMMENT

Floods and Forestration.

The Relations of Railways to the City Plan.

FLOODS AND FORESTRATION.

The discussion of the relations of rainfall, forests, stream flow, conditions of navigation at various seasons and the like is at times quite acrimonious and at the same time, perhaps, as a consequence, is far from satisfactory from any point of view. The problem is a very large one and has many variations and conditions, and, thus far, each writer on the subject has attacked it solely from the point of view of his own experience and has selected from the miscellaneous mass of unrelated, defective and more or less incorrect data available such as sustain him in his own conclusions.

As a consequence there are as many opinions as there are writers, although they range themselves in two opposing groups, which may be roughly described as believing that forests have or do not have material effect upon the navigation of our navigable rivers. To be sure, there are some who would state the differences in position in very different language, almost so different as to be unrecognizable, but the above statement is that which comes the nearest defining the position of those most closely interested from the political point of view.

This entrance of political prejudices into the question is extremely unfortunate and as long as it remains as prominent as it is at present progress will be delayed if not stopped entirely. Possibly this political element arose from the efforts of those interested in forestration to secure appropriations from Congress and the consequent fear of those interested in the improvement of navigation in the streams that their appropriations would be diminished, especially since the advocates of forestration have made rather rash claims that their work would obviate the necessity of so much stream improvement. It is easy to see how a contest could arise which would have had no reason for existence if there had been the co-operation which the magnitude of the problems and their equally great importance make necessary for the proper treatment of both. They are closely related, if not so interrelated as to be inseparable, and neither one, but especially the newer problem of forestration, has had the continued and broadly extended study which their importance requires. It is also easy to see how the slightly informed (for there are no really well-informed) partisans of each side should rush into Congress with arguments designed to influence the people and the legislators, rather than to present unbiased, careful statements of fact and careful statements of conclusion hedged by admissions of the vast lacunae in the unrelated bits of available information.

Were personal recollections admissible the writer could add some which would bring into the discussion points which have not yet been touched and which would corroborate statements made by partisans on both sides, but this would only add to the confusion and would aid only by setting down a few more facts and principles which must be considered when the complete study is made.

It is to be hoped that the discussion will soon assume a more temperate, a scientific tone and that some one with leisure and ability will attack the problem in a way to include both sides and bring out the necessities for both sides in the non-partisan, truly scientific manner which will carry conviction. Undoubtedly the result of this discussion will be to demonstrate the need of both stream improvement and

water-shed improvement, and their inter-relations, and only time and conscientious, united effort can show the best methods of meeting the individual needs of each river, stream, mountain or valley.

THE RELATIONS OF RAILWAYS TO THE CITY PLAN.

The American Institute of Architects has done a great service to the cause of better planning of cities and the revision of plans of our larger cities to suit modern conditions by bringing together for thorough discussion of the problems of the relations of railways to city development a number of experts from among the railway managers and engineers and the architects and publishing the papers and discussions in a special volume, which can probably be obtained from the secretary of the Institute Glenn Brown, Washington, D. C.

The problem is much more complicated than would seem probable until it has been studied. President Delano of the Wabash railroad read the first paper and called attention to the differences in topography as making the most pronounced differences in the solutions of the problem for various cities. Height of buildings, with the concentration of people in the districts of high office buildings; the methods of housing the population, whether in tenements down town or in houses farther out; the size of the city, and the fact that the smaller cities want the railroad stations, especially the passenger and mercantile freight stations, as near the center of the city as possible, are other important factors, according to Mr. Delano.

And the character of the passenger and freight traffic also makes a material difference in the treatment of the problem of terminals. Thus rapid transit trains within the city and immediate suburban limits; interurban electric traffic, which is omitted from Mr. Delano's consideration; local trains; through traffic; whether the city is a terminal or a way station, or both, require differences in treatment. Then, too, the freight service to and from the mercantile districts, the manufacturing districts, the building and other bulky material districts demand differences in treatment.

In the large cities there is now a strong tendency to make the distribution of both freight and passenger traffic from the railroad terminals to the congested districts by tunnels or subways.

Mr. M. A. Long, architect for the Baltimore & Ohio railroad, treated the subject from the point of view of the plan of the freight houses and tracks, their architecture and the arrangement of in and out-bound freight, cars and tracks.

The vast Hudson Terminal Station in New York and the handling of passengers and baggage and their transfer from trains to rapid and other city transit lines were described in considerable detail in a paper by J. Vipond Davies and J. Hollis Wells. The service by tunnel and subway to the station are well developed, as well as the financial reasons for the construction of the great office building over the station. The latter are mainly based on the economic necessity of raising sufficient income to carry the heavy investment in land under which to construct the station. The problem of station stairways is treated in this paper also.

John R. Rockart, architect, and I. D. Waterman and C. W. Lord, engineers, for the New York, New Haven & Hartford railroad, show the relations of the railroad buildings, retaining walls, bridges and their surroundings to city development. The wonderful work done in Washington in fitting the railroad structures to the beautiful city plan; the fitting of the railroads and stations along the Cleveland lake front into the civic center plan; the relation of the railroad station and tracks to the proposed New Haven, Conn., improvements; and the work in foreign cities, such as Paris, Genoa, Hanover, Budapest, are set forth briefly; also the defects in such large schemes as the terminal stations in Boston, the new Pennsylvania station in New York. Some of the difficul-

ties and successes in the treatment of the small suburban or through stations within the city limits or the well-populated suburbs are also shown.

The lack of study of the problem of distribution of freight is deplored and the Chicago plan for a central freight terminal, where the carloads will be broken up and the freight distributed in the district by subways, is mentioned. The use of electricity in moving the traffic within the city limits is asserted to be more economical than the use of steam.

Mr. George Cary, the designer, described the plans for the new Buffalo railroad terminals. Mr. Albert Kelsey discussed briefly interurban stations and trolley traffic in city streets.

The entire series of papers is well worth close study, and, while none of them are complete, and but few are so thoroughly worked out as to disarm criticism, they show, as a whole, the great importance of the problems and what have been the successes in the treatment of a few of them. One can read between the lines the probable success or failure of others among the projects still under discussion.

THE QUESTION DEPARTMENT

Is This a Valid Contract, and How Can Compensation Be Secured?

I enclose you outline of controversy pertaining to contracted work performed by me, as I know you have a legal department connected with your publication, which I read monthly, and it is possibly posted from experience in such a case, and can easily answer it. Attorneys here give exactly opposite opinions—that I can hold the land as per verbal contract, and that I can be ejected and verbal contract will not hold. A. ——, Ill.

"A" (a contractor) agrees with "B" (manager of a gas and electric light company, a corporation) to do certain concrete work for $855, one-half of price, $427.50, to be taken in land on which "A's" factory is located, and one-half contract price cash, $427.50. Entire plat of ground consisted of about three acres, purchased by "B" for $3,000. "A's" share was to be at this rate or 427.5 three-thousandth of the plat.

"A's" said contract with "B" was an oral contract.

"A" performed said contract for "B," which was accepted. During past two years "A" has performed work for "B" with material amounting to about $3,800 total. Head officers of said corporation again and again promised to execute and deliver said deed. This promise to deliver said deed was made by the manager and other officials of the corporation and everything was satisfactory. This contract was never put in writing, a though both "A" and "B" agreed to draw up said contract in writing.

In the five years last past "A" has constructed work in this city and vicinity to the value of about $5,000 under verbal contracts only and had never found it necessary to use written contracts which appear to cause suspicion of bad faith here, a gentleman's agreement being apparently preferable.

The last check given by "B" to "A" in payment for work performed called for balance in full, including the $427.50 which was to be paid in land. "A" received this check, upon advice of counsel, under protest and at the same time notified said company that he expected said company to keep said oral agreement in regard to said land deal and deliver deed for the $427.50 which he held for them.

The attorney now acting for said company has acted during the past five years as the attorney for "A" under a general retainer paid by "A" and accepted by said attorney.

Now said attorney for said company says that said agreement concerning said deed is void because not in writing. Is this the law under these circumstances?

The same attorney also says that even if said agreement had been put in writing it would be void unless signed by the board of directors or proper officers (other than the general manager). Is this the law under these circumstances?

During these last 24 months or more "A" has carried "B" for $800 to $1,600 without interest, borrowing at bank to do so. Now said company threatens ejectment proceedings unless "A" signs lease for land occupied by "A's" factory.

Said portion of land is more valuable now than at the time said agreement was made. "A's" factory is on railroad transfer and such another place is not to be obtained in the city. It would cost "A" several hundred dollars to move his factory even if he could get a place or location.

"A" had erected his factory upon said location previous to the time "B" or said company made said purchase, but after said purchase and said agreement for

deed was made, "A" made a number of improvements to his said factory. Never paid any rent to said company and never agreed to do so.

Questions:

Can "A" compel specific performance and get deed?

Is the use of said check a bar to "A's" action?

Can said attorney act for the company in this matter?

Did not "A" "fully perform" and thus take the case out of the statute of frauds?

Has "A" any action against the company Against said attorney? What kind of an action? Has "A" a claim for damages, and if so, for how much?

MUNICIPAL ENGINEERING is greatly complimented that the opinion of its legal department is so highly esteemed, but must feel that its opinion can scarcely be as valuable as that of attorneys on the spot, fully acquainted with Illinois laws and with the parties to the controversy and doubtless with more or less of the facts involved.

In general, the rights of an officer or employe of a company to bind the company are limited to such classes of acts as are authorized in a general way or acquiesced in by the board of directors. They may very well cover the ordinary payment of a contractor for services rendered under a verbal contract, when they would not cover payment by the transfer of the title to a piece of land. If the company contests the method of settlement named, the burden of proof will rest on "A," and all the facts in the case, including those mentioned, and others, such as the custom of the company in leaving this and like matters of business to the manager without specific delegations of authority, will aid the court in making his decision.

The actions of the attorney seem to be such as should be governed by the ethical standards of the profession, and flagrant violations are punished by proceedings for disbarment in cases which specific statutes do not reach.

Should City Contract for Electric Power?

Would it be considered wise for a municipality that already owns her utilities, water, gas and electric plants, to enter into a twenty-year contract with a private ownership corporation, for the purchase of power?

With coal at $2.25 to $2.35, under some adverse circumstances, we are producing power at 1¼ cents per kilowatt hour, as claimed by our superintendent. A limited near-by water power, that can only harness and generate from 300 to 600 horsepower desires the franchise on the general public proposition "we will do it for 25 per cent. less than city is now paying."

With a growing country and increasing population with a wider demand for current, would not a general statement like this, meet a different construction or opinion in an other administration, or generation, and result in trouble? And do not the city's franchises grow more valuable, and the rapid economic discoveries in electrical development make a term contract a dangerous proposition for a municipality to enter into?

We desire unbiased facts, as well as the possible troubles an arrangement of this kind is likely to encounter. V.

This is a question which probably requires some direct study of the local conditions and the plans and possibilities ahead of the water power company, made by an engineer expert in this sort of work, before an intelligent answer can be given. It should be possible to make a good contract, with terms allowing for modifications in its provisions as conditions change, provided the private water company is made up of responsible people, has ample water power to meet all its engagements and can enter into bond which will indemnify the city for any losses or damages due to failure of the company to fulfill its engagements with the city. The city should also have the first right to power under its contract with the company, so that, in case of partial failure of power from any cause, the city will receive its service first and other customers will be served only after the necessities of the city have been met.

Even with ample guaranties it would be far the safest and most satisfactory for the city to have the project investigated by an expert engineer acting for it, and the services of such an engineer will be worth many times their cost if he has a large voice in determining the terms of the contract, or if he finds that the company is promising impossibilities in the hope of coming out ahead on account of the lack of technical information by the city's officers.

Names of such engineers will be found in each number of MUNICIPAL ENGINEERING in the "Business Directory" under the headings "Civil Engineers" and "Consulting Engineers."

Expediency of a Municipal Electric Light Plant.

In your March MUNICIPAL ENGINEERING you refer in response to a reader's query to several issues that contained special articles on the cost, construction and maintenance of municipal light plants I am interested here in starting a discussion before the public upon the expediency of putting in an electric light plant and would be glad if you will refer me to numbers containing articles especially with reference to such a matter.

V., ————, Ky.

The best basis for such a discussion would be a report from an engineer giving a general plan for a lighting system, with approximate estimates of cost of plant and cost of operating it. This would give definiteness to the proposition and would save much misunderstanding and misrepresentation.

The current volume of MUNICIPAL ENGINEERING contains several articles of value in this connection, especially those on pp. 44, 169, 186, 249, 330, 335. Articles on pp. 107 and 346, also give references

to many previous articles directly applicable to such a discussion. They cannot, however, give the definiteness of a report applying directly to the case and based on some study of the local conditions. See also the article in this department on "Cost of Operating Arc Street Lighting System."

Current Used by Incandescent Lamp.

By burning two sixteen candle power incandescent electric lights 8 hours each day for a month of 31 days can you tell me how many kilowatt hours that would amount to?

This last month I used two lights as above for eight hours each day and the electric light company has me marked up as consuming 39 kilowatt hours. Is that correct? H., Snohomish, Wash.

Estimates of the efficiency of incandescent carbon lamps vary from say 40 to 65 watts per 16-c. p. lamp. For two lamps burning 248 hours per month the consumption of current would therefore vary from 19.9 to 32.2 kilowatt hours. If two lamps consumed 39 kilowatt hours under the above conditions the efficiency of the lamps would be low, for each lamp would require a current of 78 watts.

Cost of Operating Arc Street Lighting System.

As per your offer to subscribers of MUNICIPAL ENGINEERING, we want to ask that you send us what information you have regarding the cost of operating street arc lighting system in towns of thirty to fifty thousand population, having, say, two hundred lamps; forty of these lamps to operate on all-night schedule and one hundred and sixty on moon-light.

We are especially anxious to obtain data on the cost of arc lamp carbons, inner and outer globes and lamp repairs per annum.

The writer has always used forty-five dollars as rough figures to take care of all cost of operation from a 6.6 ampere series alternating current arc lamp, but we would like to know what it has cost other plants. G., ————, Tenn.

The best analysis of all the costs of a gas, electric light and street railway system, carefully separated and classified so that every item stands clearly by itself for a city of slightly less than the size named will be found in the decision made March 8, 1910, by the Railroad Commission of Wisconsin in the case of the State Journal Printing Co., et al., vs. Madison Gas and Electric Co.

The cost of such items as globes, carbons, etc., is not given, but the fixed cost of supplying light and the cost of current is carefully separated. The fixed cost includes cost of maintenance, repairs, supplies, interest, dividend and sinking fund or depreciation charges and amounts to $22.49 per lamp per year for the 271 arc lamps used in lighting the streets of Madison. The 216 lamps operating until midnight required 835 kilowatt hours of current each per year, the cost of which was $28.82 a year, making a total cost per lamp per year on midnight schedule of $51.31. The fifty-five lamps run all night required 1,558 k. w. hrs., costing $53.78 per year, making the cost of an all-night lamp, $76.27 a year.

An article in MUNICIPAL ENGINEERING, vol. xxxviii, p. 249, gives some figures of cost of labor and materials per lamp for trimming various kinds of lamps used for street lighting and also an estimate of the cost per lamp for repairs.

Other articles in the current volume, containing more or less information on the specific question asked and on matters related thereto, some of which give references to previous articles, will be found on pp. 44, 107, 166, 169, 186, 187, 330.

Exchange of Telephone Service Between Rival Companies.

Can you give me the names of any cities of 30,000 or more population having more than one telephone system or company, that is, the Bell and an independent company, and any of such requiring an interchange of business so that subscribers of one company can talk with subscribers of another company?

J. DAVID REED,
Mayor, Portsmouth, Va.

The writer knows of no such exchange of services in cities of the size mentioned. There is such exchange in some very small towns and villages. Can our readers cite any cases of such exchange in either large or small places?

Excessive Rates for Water and Electric Light.

I enclose you a copy of the franchises which the present city government found existing, when it took charge of the city affairs. I would appreciate it if you could compare our water rates and electric-light rates with those paid by other cities of about our population, 5,000. Our citizens believe they are paying too much for both. Our water is pumped from the Missouri River into reservoirs to an elevation of 185 feet and from there is distributed by gravity throughout the city. Our citizens believe the water rates very excessive, and we would like light on the subject if you can give it to us.

E. A. WILLIAMS,
Pres. Board City Commissioners,
Bismarck, N. D.

The water rates given in the latest franchise state that the company "shall not charge the said city for water for sprinkling streets and flushing sewers a sum to exceed 12 cents per 1,000 gallons; provided, that all sewers covered by this provision shall have a fall of at least 6 inches to each 100 feet; and no charge shall be made for water for the use of the fire department for fire purposes except the annual amount or sum herein specified for the use of each of the fire plugs or hydrants hereinafter mentioned; and said company shall not charge any of the inhabitants of said city, or any person, company or corporation engaged in selling water from wagons, to exceed

7 cents per barrel of 40 gallons: and shall not charge to exceed 40 cents per 1,000 gallons for the water furnished to any person, firm or corporation using said water solely for the purpose of irrigating lawns and gardens, or for the production of hydraulic power, or for running motors." Another section fixes the hydrant rental at $75 per hydrant per year for the term of the contract, to May 26, 1926.

The latest electric light franchise provides that the company "shall not charge the city of Bismarck for electric lights for city purposes at a rate to exceed 33 1-3 cents per night each for 1,200-c. p. arc lights; provided that the said city shall take at least 10 such lights if any be ordered; nor a rate to exceed $2 a month each for 16-c. p. incandescent lights; and the prices to be charged the inhabitants of said city shall not exceed the rate of 1 cent per hour on each 16-c. p. incandescent light; nor at a rate greater than 6 cents per hour each for 1,200-c. p. arc lights." Another section provides that all-night service may be required for city lights. This franchise runs 30 years from May 18, 1905. A later ordinance fixes the price for 16-c. p. gas at $4.50 per 1,000 cubic feet, with four free burners during council meetings.

An earlier ordinance gave a 25-year franchise from Aug. 10, 1900, at not to exceed 20 cents per 1,000 watts and contained the provision that three arbitrators should be chosen on notification by the city council, who should hear "proofs and allegations of parties" and "fix a price by report in writing" to be paid by the city for electric light during the period, not less than one year, submitted to the arbitrators for adjustment. This provision does not seem to have applied to rates for private service.

The private water rate of 7 cents for 40 gallons is evidently $1.75 per 1,000 gallons, for water for household purposes, as compared with 40 cents for water for irrigation purposes and 12 cents for water for sewer flushing purposes. It is difficult to see the effect of the gradient of a sewer on the price per 1,000 gallons of water for flushing it. In the most complete table of water rates published, found in the "Manual of American Water Works" ($5), there is one small place charging $1.60, asother charging $1.50, 7 others charge $1, 3 others 75 cents, 3 others 70 cents, and less than 5 per cent. charge more than 50 cents per 1,000 gallons maximum. While no definite opinion can be expressed regarding the correctness of a given rate without full knowledge of the expense of supplying the water, a rate so much higher than those in other cities is presumably excessive, especially since there seems to be no difference in the water supplied for domstic irrigation and sewer flushing purposes. The $75 rate for hydrants is not so excessive, but it is about 30 per cent. in excess of the average small towns.

The rate for arc lights equals about $121 per lamp per year, and that for 16-c. p. incandescents $24. These rates are something like 30 to 35 per cent. higher than the average, but cost of fuel or labor or freight may justify the excess. This can be determined only by a careful study of the subject on the ground.

The rate for private lighting is so peculiar that a statement of the way in which it is applied in practice would be necessary before any judgment regarding its fairness could be made.

The modern tendency is to regulate rates with reference to the necessities of each case, after careful expert study of the actual facts. The decisions of the Wisconsin Railroad Commission show the scientific method of attacking the problem. The article in the May number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 335, on "Co-operative Franchises for Municipal Public Service Corporations," and the articles to which it refers give methods of applying the same principles in cities in states not having such state public service commissions.

Profile of Gas Pipe Line.

I would like a little information regarding the resistance of gas going through a pipe. The line being in a mountainous country, if a deep valley can be avoided, say 300 feet depth, would it be policy to go around such a valley by lengthening the pipe, say 100 or possibly 200 feet? Of course, there are places it cannot be done, but when it can be done on a line 40 miles or more long, I think it would be well to go on as uniform a grade as well as line as possible.

D., Kane, Pa.

There have been but few scientific observations on the flow of gas in pipes and the effect of undulations in the gradient of a long gas pipe line is not very definitely known. Gas being lighter than air, it is of course an advantage, for it to flow up hill, and every dip in the grade line means additional power expended in pumping. It is certainly better to follow a uniform gradient whenever it is possible.

Can any of our readers give results of observations or references to records of such results?

Pressure of Water in Pipes.

What would be the pressure in a water main 4 to 10 inches large from a tower tank of 150,000 to 200,000 gallons capacity, height 80 to 100 feet?

CITY CLERK, ———, Kan.

The data are not sufficient to answer this question exactly. If the water is standing still in the system, the pressure at any point will depend on the elevation of the surface of the water in the tank above the point in the pipe at which the

pressure is desired. If the tank is 100 feet high and is full of water, and the point in the pipe at which the pressure is desired is at the same elevation as the bottom of the tank the pressure will be about 43 pounds. If the difference of elevation is more or less than 100 feet the pressure will be more or less in the same proportion.

If water is flowing in the pipe the pressure will be reduced by the friction and other resistances to flow, and the amount of this reduction will depend mainly on the size of the pipe, the velocity of flow of the water, and the distance it flows in the pipe from the tank to the point where the pressure is measured. This loss of pressure should be small and will be in a well designed system, but it is sometimes excessive in water works systems not designed by experts.

Materials for Mosaic Floors.

I would like to get some information regarding mosaic floors, as to where I can buy mosaic crushed per ton in different colors, also half-inch tile and emery stone to rub or polish with. The mosaic I would like to get varies in size about the size of a pea. It is placed on concrete and then rubbed down with emery stone, and half-inch tile is placed in expansion joints.

M., Mt. Clemens, Mich.

There are many dealers in such mosaic materials. Those nearest the location named are American Mosaic Co., 97 Shelby street, Detroit, Mich., ceramic and marble mosaics; E. A. Bressler Co., 26 Lafayette ave., Detroit, Mich., ceramic; Venetian Marble Mosaic Art Co., 98 Brush st., Detroit, Mich., marble; John Caretti & Co., 172 Michigan ave., Davis, Marble Co., 302 Michigan ave., Hawes & Dodd, 24 Adams st., Chas. F. Lorenzen & Co., 278 N. Ashland ave., Weary & Beck, 164 Dearborn st., Daprato Statuary Co., 173 W. Adams st., Davidson Bros. Marble Co., foot of Orleans st., M. Keating & Sons Co., 224 Washington st., Wm. H. Jackson Co., 163 Michigan ave., Chester N. Marthens Co., 701 W. 53d st., Sherman-Flavin Marble Co., 2519 State st., all in Chicago, Ill.; J. C. Iversen, 425 E. Water st., Milwaukee, Wis.; Lautz Co., 861 Main st., Mosaic Marble and Enamel Co., foot Hudson st., Buffalo, N. Y.; Norcross Co., 1264 Riverbed, Vincent-Barstow Co., 725 Euclid ave., Chester J. Wadsworth, 5806 Euclid ave., Cleveland, O.

Information About Water Rates.

I am very desirous of securing a report covering the water rates of the various cities in the United States, and would be glad to have you send me at once, at our expense any publications, books or pamphlets which you may have on the subject.

I understand that a report was published in 1907, the same being a paper read at the twenty-eighth annual convention of the American Water Works Association in 1907, by Dow R. Gwin, the same being entitled "Water Rates Charged in 375 Cities." If you haven't a copy of this pamphlet, I would be glad if you will give me Mr. Gwin's address so that I may write him direct

R., Macon, Ga.

The largest collection of water rates is that in the "Manual of American Water Works" for 1897 ($5), although the rates are somewhat condensed on account of the limitations of space. Copies of Mr. Gwin's paper may possibly be obtained by addressing him at the water works office, Terre Haute, Ind., and copies of the annual volume of proceedings of the association containing the paper can be obtained of the secretary, J. M. Diven, of the Water Works Company at Charleston, S. C., and will probably cost one dollar.

Comparisons of water rates in other cities are of little real value in determining the rates in a given city. Conditions vary so much and cost of operating varies so much that the new rates should be determined after a thorough study of the income and expenses of the plant and of the probable effect of any changes in the rates. The methods employed by the Wisconsin Railroad Commission in revising rates are the most scientific and give the most satisfactory practical results.

Makers of Concrete Block Machines.

Will you please inform me where I can buy cement block machine for making hollow moisture proof blocks as illustrated on page 159, Brown's "Hand Book for Cement Users," issued by you, dated 1905, and oblige. C. M. M., Murdo, S. D.

Such machines can be obtained of the Ashland Steel Range and Manufacturing Co., Ashland, O., the Fisher Hydraulic Stone and Machinery Co., Baltimore, Md., the Waterloo Cement Machinery Corporation, Waterloo, Iowa; the American Cement Machinery Co., St. Louis, Mo.; A. F. George Co., Los Angeles, Cal., and others. Reference may be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Cement Block Machines," "Cement Brick Machines," "Concrete Blocks," "Concrete Construction Machinery."

The makers mentioned make blocks by different processes, but can all give instructions for making waterproof blocks by their methods.

Articles on Concrete Paving.

Has there appeared in any recent number of MUNICIPAL ENGINEERING a comprehensive article on concrete paving? I am looking for such information as to cost, specifications and efficiency.

M. E. C., ————, Minn.

The following articles have appeared in the last few volumes of MUNICIPAL ENGINEERING:

In vol. xxxvii: "Specifications for concrete sidewalks, curbs and gutters and pavements," p. 244.

In vol. xxxvii: "Will a Concrete Street Crack?" p. 35; "Cost of Street Paving," p. 177. The article on p. 35 refers to a number of prior articles describing various forms of concrete paving, such as the Blome, in vol. xxxv, p. 369, and vol. xxxiv, p. 412; a German pavement in vol. xxxv, p. 36; Richmond pavements in vol. xxviii, p. 388, and vol. xxxiv, p. 168; the Toronto pavements in vol. xxvii, p. 350; the Grand Rapids pavements in vol. xxiii, p. 400; the Bellefontaine pavements, now about 20 years old, in vol. iv, p. 229, vol. xvii, pp. 383, 384, vol. xix, p. 427, vol. xxxv, p. 180, and others.

Cast Stone Boat Ends.

For sometime I have looked for information or advertisement in regard to cast stone boat crooks or ends. If you will inform me I will write for description and price. Would like one that can be used with a pole.

W. H. T., Rhinebeck, N. Y.

Can any of our readers answer this inquiry?

Forms for Concrete Sewers—Books on Reinforced Concrete Sewers.

I desire to obtain the names of manufacturers of forms for concrete sewer work. Also names of books which give most information on design and construction of reinforced concrete sewers. Such information as you may be able to give me will be greatly appreciated.

E. R. W., Port Huron, Mich.

On page 368 of the May number will be found a list of patents which contains several on molds for concrete sewers and pipes. The American Cement Machinery Co., St. Louis, Mo., can supply the desired forms. Other makers of such forms are the Adjustable Steel Centering Co., Fond du Lac, Wis.; Blaw Collapsible Steel Centering Co., Pittsburg, Pa.; Merillat Culvert Core Co., Winfield, Iowa; Ray Thomas, Faribault, Minn.

More or less information about the construction of reinforced concrete sewers will be found in Taylor & Thompson's "Concrete, Plain and Reinforced" ($5), and Buel and Hill's "Reinforced Concrete" ($5).

Sanitary Provisions Without Water or Sewers.

Our Board of Health is desirous of obtaining information as to the best method of outdoor closet to adopt as a regulation closet for use in those parts of our city where sewer and water connection can not be obtained.

Outside our water and sewer area and in many of the older class of houses within, we have up to the present had in use closets equipped with a sanitary pail. This we have found to be an expensive method as these pails have to be emptied both winter and summer, once per week. In winter a thawing process is necessary as a preliminary and in summer the odor from these pails is very insistent; moreover we have reason to believe that the flies feed on the contents of these pails and convey typhoid poison to food supplies in houses, thus explaining the large number of cases we have usually in September and October each year.

I am of opinion that pits of a regulation depth suitable for cleaning, with a regulation closet, would be less objectionable, less expensive and more sanitary than the pail or box system, provided wells are prohibited. Our soil here is a heavy clay somewhat impervious to moisture. City water is obtainable from the water wagons by those who cannot get water service at present.

I would be glad to have any information you can give me as to the method you have found best in your city, and also your opinion of the comparative merits and defects of the pail or box system and the pit system.

T. H. WHITELAND,
Medical Health Officer,
Edmonton, Alberta.

Any provision for taking care of house wastes other than immediate removal by water carriage requires the most rigid and constant supervision by the health authorities, but it is possible to inaugurate a comparatively inexpensive system and to operate it without nuisance, the great expense being in the payment of the force of inspectors.

It is possible to operate earth closets inside the house without odor or danger from flies in both summer and winter, but they must be used only for human excrement and there must be a sufficient supply of dry absorbent earth or fine ash, or a mixture, so that every solid or liquid deposit shall be completely covered and absorbed as soon as made. The use of such closets can be learned as readily as the use of water closets, but the average citizen, not to speak of the children, is too careless to perform the covering process completely and carefully. This accounts for the freezing of the contents of pails in the winter and consequent difficulty of removal if they are used in a cold outbuilding, for natural carelessness about such use is emphasized by the desire to get in out of the cold. Between the possibility of odors due to carelessness in the use of the earth closets in the house and the almost certain difficulties of removal in the winter if they are located in outbuildings, the authorities much choose according to their local conditions.

Perhaps the removal problem would be somewhat simplified if the full pails or boxes were carried to the place of disposal for emptying, a clean pail being left in place of each full pail removed from a residence. If necessary there might be a provision for placing the pails in a heated room for thawing out, and there should be a provision for thorough cleaning and disinfection before the pails are again used.

The matter of earth closets and also that of vaults or pits is briefly but comprehensively treated in Chapins' "Municipal Sanitation in the United States" ($5), a most valuable book for the health departments of cities.

In the January number of MUNICIPAL

ENGINEERING, vol. xxxviii, p. 37, will be found a collection of regulations governing the cleaning of vaults or pits and regulations of their size, much of the information being taken from Dr. Chapin's book.

As to which method produces the least nuisance and can be operated with the least trouble and expense, no definite answer can be given. It depends upon the habits and customs of the people. If they have been brought up to the use of the earth closet there will be little or no difficulty in operating that system. If they have been accustomed to the pit or cesspool system it will be difficult to teach them the necessity of careful operation of the earth closets. The pits are almost certain to become nuisances unless cleaned and thorough disinfected at reasonably frequent intervals. They will have the advantage in a cold climate that it will not be necessary to clean them during the winter, but it is difficult to disinfect or deodorize them without cleaning them, especially if any water except human excrement drains into the pit. The writer is disposed to favor for a city in the latitude of Edmonton, the pits if deep enough, made of concrete, water tight, with no overflow, and protected from the entrance of any water. If cleaning is delayed they can be deodorized when necessary by comparatively small doses of chemicals dissolved in water and careful deposit of dry absorbent fine earth and ashes.

If a residence has water supply, but no sewer, the Ashley residential septic tank, described in MUNICIPAL ENGINEERING, vol. xxiii, p. 35, or those described in vol. xxiii, p. 37 and in vol. xxxv, p. 244, may be found available.

Book on Sewer Pipe Manufacture.

Will you very kindly advise where the writer can secure a book on the manufacture of vitrified sewer pipe?

I. M., Kansas City, Mo.

The writer knows of no book on the manufacture of vitrified sewer pipe, and of but one, Hanson's, on the manufacture of cement tile and pipe. Can our readers give any information on the subject?

How to Pay for Sewer System.

The city of Phoenix is contemplating at the present time the installation of a sewer system costing in the neighborhood of $400,000, and no little argument is being used as to the best means of raising the money for this particular purpose.

If I could trespass on your time I would appreciate it very much if you would furnish me with such information as you may have as to the most advanced means adopted at the present time by municipalities for raising the funds necessary to install sewer systems.

The argument here is against a straight bonding proposition and for the assessment plan. Some few of us have pronounced ideas as to which is the better method, but they are apparently not convincing, and I should like some information from an authentic source as to the methods employed.

H. S. R., Phoenix, Ariz.

This question should be answered for the city of Phoenix by some one familiar with the laws of Arizona.

Theoretically there are three principal elements in the assessment of the cost of sewers which should be considered in every case. Practically all but one or two of them, not always the same, are neglected.

If the whole sewer system is constructed at once, it may very well be paid for by the city at large, the money being raised by bonds or directly by tax. But a strict application of the principles referred to would cause the assessments of benefits to be distributed in a manner somewhat like that stated below.

If parts of the sewer system are constructed at different times, the following points should be considered:

1. The sewer system is of benefit for drainage largely in proportion to area and this portion of the cost should be assessed according to area.

2. It adds to the value of a lot in proportion to the value of the lot, if it is assumed that every lot requires a connection for sanitary purposes. This statement may be modified somewhat in the case of lots used for some particular purposes, such as storage warehouses, coal yards, etc., which require but little in the way of sanitary service.

3. The city as a whole is benefited by drainage and general sanitary improvement and should pay its share of the cost, say for drainage in proportion to area of public streets, grounds, buildings, etc., and for sanitary purposes according to the best judgment of the assessing authority.

4. A main sewer benefits the whole district which will ultimately drain into it, and the cost of such sewers in excess of those for the purposes of the abutting property should be distributed over the whole drainage district in accordance with the preceding principles. A local sewer may be assessed directly upon the abutting property benefited, including the city for the common areas.

The subject is discussed in considerable detail in a number of articles which have appeared in MUNICIPAL ENGINEERING, the latest of which, in the March number, vol. xxxviii, p. 190, contains references to the others.

Catchbasins on Unpaved Streets.

Renville is a town of about 1,500 inhabitants, and is putting in a drainage system for storm water, cellars, low ground surface water, etc. In the principal streets would you recommend a simple form of catch basin for storm water inlet or would you recommend a street inlet running direct to the drain? The streets are not paved. Would there be danger of silt being deposited and

clogging the drains, the grades varying from 0.10 to 0.20 per cent.

C. W. J., Renville, Minn.

Presumably the drains will be of vitrified pipe, the circumstances not requiring them to be so large that brick or concrete must be used. In such case the lowest gradient named, which is equivalent to a fall of 1 foot in 1,000, would hardly be strong enough to insure that the sewers would be self cleansing, with large quantities of silt washed in from the unpaved streets.

Catch-basins are of no value unless the deposits in them are cleaned out before the basins are filled up to the level of the outlets. The question is therefore one of comparison of the cost of cleaning catchbasins whenever test shows cleaning to be necessary and cleaning sewers at regular intervals so that there will be a certainty that they will not be stopped up. Probably the catchbasin cleaning will be the cheapest with unpaved streets, especially if the streets are not hard macadam streets, but are subject to wash by the general passage of heavy rainfall over the surface or of large quantities flowing rapidly in the side ditches or gutters.

If it were possible to give the drains more fall and the streets were paved, and no sewage entered the drains the case might easily be reversed.

Books on Macadam Roads.

Is there any book published which is considered an authority on macadam streets and roads?

"Kidder" and "Trautwine" are authorities in their line, and if there is such a book covering road building, particularly crushed stone construction, we would like to get it. V., ———, Ind.

An excellent book covering all parts of the standard macadam road, not treated with oil or tar, is Byrne's "Highway Construction" ($5); Aitken's "Road Making and Maintenance," is an English book which is also standard. Books treating of methods of improving the quality of macadam roads, all new, are Hubbard's "Dust Preventives and Road Binders" ($3); Smith's "Dustless Roads, Tar Macadam" (English, $3.50); Judson's "Road Preservation and Dust Prevention" ($1.50).

Where Has Gilsonite Been Used in Asphalt Pavements?

Can you give me any information through the question department of your magazine as to where, in what cities (first class) there has been any Gilsonite asphalt material laid and with what success.

J. B., Milwaukee, Wis.

Gilsonite is reported to have been used in asphalt pavements at some time during the last fifteen years in the following cities: Chicago, Ill.; Waterloo, Des Moines, Mason City, Iowa; Oklahoma City, Guthrie, Sapulpa, Muskogee, Shawnee, Okla.; Denver, Col.; St. Louis, Kansas City, Mo.; Ft. Wayne, Ind.; Memphis, Tenn.; Montgomery, Huntsville, Ala.; Wichita, Kan. The writer has not knowingly seen any of these pavements except those at Ft. Wayne, which are about eighteen months old, having passed through two winters. They promise to require very slight expenditure for repairs during their ten-year period of guaranty. Such reports concerning the others as have reached the writer indicate that they are equally satisfactory.

Can any of our readers give the results of their observations of Gilsonite asphalt pavements, giving detail of date and method of construction and present condition?

As shown by the report in MUNICIPAL ENGINEERING, vol. xxxvii, p. 255, the amount of Gilsonite produced has increase from about 11,000 tons in 1905 to about 19,000 tons in 1908. Some of this increase has been on account of increased use in pavements, although Gilsonite is extensively used also in the manufacture of paints, varnishes and other products requiring a very pure asphalt.

Garbage Disposal in America.

Nous vous serions tres obliges si vous pouvez nous documentes sur les resultats obtenus en votre pays par les procedes de cuisson des ordures menageres ongadues des villes pour la production de la vapeur ou des engrais. Ou a-t-on fait des applications de ce systeme et a qui pouvons nous nous addresser pour obtenir des resseignements detailles a ce sujet.

BAUDY,
Chaumont, Haute Marne, France.

Morse's book on "The Collection and Disposal of Municipal Waste" ($5) gives descriptions of practically all the garbage disposal plants in the United States. His article in MUNICIPAL ENGINEERING, vol. xxxviii, p. 258, describes the systems of destruction of garbage, including the production of steam. The series of articles by Hugh S. Watson, in vol. xxxvii, p. 287, vol. xxxviii, pp. 1, 73, 143, 229, 299, etc., while written by an Englishman, well describes American practice in garbage destruction at high temperatures, for practically the same furnaces are used in both countries. Other articles describing less satisfactory methods of garbage disposal will be found in vol. xxxvi, p. 36, and vol. xxxv, pp. 179, 359 and 376, and others in still earlier volumes.

Information About Public Markets.

I write to ask that you refer me to any copy or copies of MUNICIPAL ENGINEERING that deals with the subject of city markets, their dimensions, general plan and method of operation. If this subject has not been covered by your journal, I will appreciate your giving me any information that will lead to my getting up-to-date literature on this matter.

L. E., Little Rock, Ark.

Only recently have any approximately thorough studies been made of the prob-

lems of the public market and, so far as the writer knows, none of these have found their way into book form. The proportion of stand-space to passage-ways, the volume of air in the room, the supply of heated or cooled air of proper humidity, the separation into departments for different kinds of marketable products so that each department will have its supply of proper volume and quality, the control of the air supply so that the variations in number of people can be provided for, the extraction of odors and prevention of their spread out of their departments, the supply of day-light without direct sunlight during market hours and of direct sunlight during vacant hours for purifying purposes, the provision of closed cases, humidors and refrigeration for the products requiring these various treatments, the provision of thorough drainage, and arrangement of stands so that thorough washing with plenty of water under pressure is easy, the provision of convenient methods of collecting and removing the solid refuse, the provision of cold storage and dry storage, and a number of lesser, related problems should all be considered in the design, construction and operation of a market. But few architects or engineers have made these studies. The writer knows but one or two.

Some of these matters have received a reasonable amount of attention in a market recently constructed by a private company in Seattle, Wash., some description of which will be found in an article in the department "From Workers in the Field."

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Experts in California Asphalt.

The undersigned notes in the Question Department, MUNICIPAL ENGINEERING, April number, an inquiry regarding asphalt paving experts who have had some experience with California asphalts. As I am always willing to give any one interested the benefit of my experience in the asphalt paving industry, it may not be amiss for me to advise the gentleman making inquiry that I have been continuously engaged in the asphalt paving industry since 1883. Until five years ago I was connected with companies using so-called "natural" asphalts exclusively.

About that time I became interested in the asphalts manufactured from the heavy malthas obtained on the Pacific coast, and after careful and exhaustive examination I was led to conclude that asphalts properly produced from that source were far superior to most of the so-called "natural" asphalts. I have since been interested entirely in the California productions and will be pleased to give anyone interested the benefit of my experience in that line, as it has been undoubtedly proven that pavements laid from California asphalt which has been properly refined and is properly used at the paving plant is a very superior pavement.

In 1903 220,416 tons of so-called "natural" asphalt was imported to the United States, while only about 32,000 tons of California material was marketed. The year 1907 shows that about 65,000 tons of so-called "natural" asphalt was imported in the United States, whereas 110,000 tons of California were produced and sold. There must be a reason for these figures, which are approximately very correct.

GEO. W. LAMSON.
Chicago, Ill.

Form for Water Bill.

The face of the bill for water used by the water commission of Frankfort, N.Y., is shown in the accompanying cut, also of the stub. A notable point is the method of securing advance payment on a bill for metered water. The bill is for six months and the minimum bill is $7 a year or $3.50 for six months. For the first six months of the contract, or proportionate time to October 1, the consumer pays in advance the half or proportionate amount of $7. Thereafter he pays in advance half of the bill for the preceding year, so that, while he is paying in advance for

water he is actually paying the amount which accrued from his use of water during the preceding year. This is shown in the fine print on the face of the bill. Following are the items of information given on the back of the bill:

RULES AND RATES.

I. All bills are made to the owner of the premises and are due when presented.

II. Meters must be easy of access at all times for examination by the water commissioners.

III. They must be protected from freezing or other injury by the care and at the cost of the water consumer.

IV. Meters must not be tampered with and must not be removed without notice to the water commissioners.

V. If a meter gets out of order and fails to register, the consumer will be charged at the average daily consumption of water as shown by the meter when in order.

VI. All water passing through the meter will be charged for whether used or wasted.

VII. No meter rate less than $7. One cubic foot of water is seven and one-half gallons.

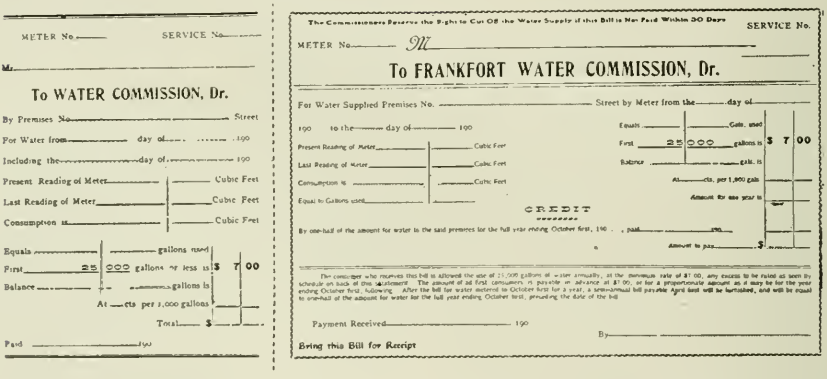
VIII. Every consumer of water should learn to read his meter and observe that there is no waste of water by leakage. Meters will not register more water than passes through them. To test a meter, close all fixtures and watch the hand on the dial registering the smallest number of cubic feet. If the hand moves at all, there is a leak—find it and have it stopped. Its further accuracy can be tested by the consumer at any time by noticing whether the meter registers one cubic foot when seven and one-half gallons or sixty-two and one-half pounds of water is drawn from the pipe.

VILLAGE ORDINANCES.

Chapter XII. Sec. 1. Water Rents.—All water rents may be paid semi-annually in advance at the First National Bank of Frankfort, New York, on or before the first day of April and October of each year, and five per cent will be added to and collected on all water bills remaining unpaid 20 days after the water rents shall actually be due and unpaid; and should any water rents remain unpaid for a space of 30 days after the same is due and notice personally served upon the party or person owning the premises to which the water is supplied, or on the agent thereof that said water rent is due and unpaid, the supply of water to said premises shall be shut off.

STATE LAWS.

Sec. 227. Connections with Mains.—Supply pipes connecting with mains and used by private owners or occupants shall be laid and kept in repair at their expense. Such pipes can only be connected with the mains by permission and under the direction of the Board of Water Commissioners. A member of the board or its authorized agent may at any time enter a building or upon premises where water is used from supply pipes and make necessary examinations.


METER No.
SERVICE No.
To WATER COMMISSION, Dr.
By Premises No. Street
For Water from day of 190
Including the day of 190
Present Reading of Meter Cubic Feet
Last Reading of Meter Cubic Feet
Consumption is Cubic Feet
Equals gallons used
First 25 000 gallons or less is $ 7 00
Balance gallons is
At cts per 1,000 gallons
Total $
Paid 190
The Commissioners Reserve the Right to Cut Off the Water Supply if this Bill is Not Paid Within 30 Days
SERVICE No.
METER No. M
To FRANKFORT WATER COMMISSION, Dr.
For Water Supplied Premises No. Street by Meter from the day of
190 to the day of 190
Present Reading of Meter Cubic Feet
Last Reading of Meter Cubic Feet
Consumption is Cubic Feet
Equal to Gallons used
Equals Gals. used
First 25 000 gallons is $ 7 00
Balance gals. is
At cts. per 1,000 gals
Amount for one year is
CREDIT
By one-half of the amount for water in the said premises for the half year ending October first, 190 paid 190
Amount to pay $
Payment Received 190
By
Bring this Bill for Receipt

RATES FOR WATER WHEN USED THROUGH METERS.

25,000 gallons or less, per year, lump price yearly, equal to 28 cents per 1,000 gallons, is the sum of $7.00.

1. 35,000 gal. or less, per year, each 1,000 gals., 24 cts. after first 25,000 gals. is $7.24—$9.40.
2. 50,000, 21 cts., $9.40—$12.25.
3. 65,000, 18 cts., $12.25—$14.20.
4. 85,000, 15 cts., $14.20—$16.00.
5. 105,000, 13 cts., $16.00—$17.40.
6. 225,000, 12 cts., $17.40—$31.00.
7. 500,000, 11 cts., $31.00—$59.25.
8. 1,000,000, 10 cts., $59.25—$104.50.
9. 1,700,000, 9 cts., $104.50—$157.75.
10. 2,600,000, 8 cts., $157.75—$213.00.
11. 3,500,000, 7 cts., $213.00—$250.25.
12. 5,000,000, 6 cts., $250.25—$305.50.
13. 8,000,000, 5 cts., $305.50—$405.75.

All greater quantities at the rate of 5 cents per 1,000 gallons.

A bill for 35,000 gallons used in a year would be computed thus:

35,000 gal. meter reading.
25,000 gal. at.....$7.00
10,000 gal. at 24c..... 2.40
Total $9.40

After the first year half of this amount could be paid in April and the other half in October, as shown on the face of the bill.

Day Labor vs. Contract Work on Los Angeles Aqueduct.

The following interesting communication appeared in a recent number of *Pacific Outlook*, published at Los Angeles, Cal.:

In your issue of December 11, 1909, you publish a copy of an article which appeared in "Engineering-Contracting," reviewing a report by Metcalf and Eddy, consulting engineers of Boston,—this report having been made to the Boston Finance Commission on the relative economy of doing public work by contract or by municipal day labor, called "force account." The finding is that force account work is the more expensive method in certain New England cities.

The entire tenor of the article is to the effect that all public work should be done by contract. The report by Metcalf and Eddy has been extensively reviewed by engineering publications. The firm of Metcalf and Eddy are engineers in good standing, but it should be remembered that "Engineering-Contracting" is a paper that is devoted to the interests of the contractors of the United States.

Much municipal work has been done in the past without adequate supervision and economic management, men of low efficiency often gradually accumulating in a permanent organization. When public work is performed politically, there is no limit to the extravagant costs that may result, just as there would be under contract work resulting from collusion, and a discussion thereof is superfluous. The question, therefore, resolves itself into one of whether municipal work can be organized on business principles. There is no reason why a municipality with large financial resources, capable of buying adequate equipment and paying reasonable salaries, should not obtain as high grade machinery and superintendents as any contractor. Manufacturers take pride in selling their equipment to a municipality or to the Federal Government, and advertise such sales extensively. Most young men, and particularly ambitious young engineers seeking experience and reputation, desire connection with large public organizations in an official capacity, provided the job is clean, and they are usually willing to work at less wages than they would for an individual.

Let no one think that the engineering direction of public work under contract is a flowery bed of ease. It requires as much detailed supervision and vigilance as if the work were carried on by an organization reporting directly to the engineer. Often when contractors encounter great difficulties and unexpected expenses, the municipality and the engineer are left to finish the work. This was illustrated in the case of the outfall sewer in Los Angeles and at the Laguna Dam which was started for the Reclamation Service by one of the largest contracting firms in the United States. Conversely, if the work proves unexpectedly easy, the municipality would not share in the resulting good fortune. It is often a case of "heads I win and tails you lose."

There is more temptation for a contractor, no matter how honorable he may be, to skimp his work for which he is paid a fixed sum, than for a municipality to slight its own work under the force account system. Pieces of work on which the costs are very uncertain, such as tunnel driving and foundation work, are those best suited to the force account system, because a good contractor must assume all unfavorable conditions as occurring, and bid accordingly.

When public work is let by contract, it must be as the result of advertising and the law usually compels the award to the lowest bidder or to the lowest responsible bidder. In our own street work, it must be the lowest bidder or all bids must be rejected. The lowest bidder may be a bidder with bad judgment as to probable costs, and while his bid may be protected by bond, the bond is of little practical value. I have never known of collection on a contractor's bond.

The greatest advantage that the contractor enjoys is that he can purchase materials and employ men quickly, whereas municipal officers are seriously incumbered with formalities, designed to prevent fraud, but which are an expensive handicap to an honest administration.

The Los Angeles Aqueduct is in charge of a non-partisan and most efficient board of public works. About 95 per cent of the work is done by force account. There is not a political appointee in the entire organization. The engineers are energetic young men, ambitious to make reputations and are promoted on merit. The bonus system is applied where possible, and the results so far obtained have been most satisfactory.

The Jawbone Division is twenty-two miles in length and is the heaviest on the Aqueduct. Consequently, it was one of the first to be opened for construction. In order to determine whether this work should be done by contract or by force account, bids were called for; these were compared with the engineers' estimates and finally all bids were rejected and the engineering department ordered to construct the work by force account. Mr. A. C. Hansen was placed in charge as division engineer.

The Jawbone Division is now 80 per cent completed. It is possible, therefore,

to make a comparison between the cost of the work done by the municipality and the prices bid by the contractors. It will be appreciated, however, by any person who has had experience in construction work, that the unknown elements of the cost for "extra work" done by the contractor are most important ones, which do not appear in a bid but which are covered by the force account cost figures which are here presented.

These "cost figures" are reliable; each piece of work is made the subject of detailed study. All charges for general expense, equipment, housing, sanitation, administration, etc., are included. The analysis was made by Mr. O. E. Clemens, in charge of the cost-keeping department of the Aqueduct.

Of the 217 miles of Aqueduct, including three hydro-electric plants and one cement plant, all work is being done by force account with the exception of 11 miles of valley work.

One feature of this work which has been effective in securing good results is the issuing of monthly cost and progress bulletins covering every structure. These show unit costs of similar work at different places, giving credit to those in immediate charge and advertising their results, whether good or bad, throughout the entire organization each month.

COST ANALYSIS.

Five bids were received July 27, 1908, for the construction of the Jawbone Division, as provided in Specification No. 33. These bids, with the exception of the lowest, were submitted by large and experienced contracting firms from various parts of the United States. The unit prices of the low bidder are shown under the tables of costs.

As stated elsewhere, the estimated quantities shown on the original specifications have been somewhat modified to meet conditions developed during construction, the tunnel footage having been materially increased and conduit footage decreased. The comparisons of costs have been based on the quantities as now established. The estimated cost of engineering, in case the work had been let by contract, has been added to the contractor's bid. This expense under the force account system has also been included in the costs shown.

The following plant, according to Specification No. 33, was to be installed or built by the city, for the free use of the contractor. The cost of this has been eliminated from this analysis:

Compressor plants.
Main water pipe lines.
Roads and trails.
Power lines and transformer stations.
Main telephone lines.

The charges for electric energy which would have been made to the contractor have been included in force account costs. The comparison of costs is made on tunnel and conduit work, the cost of culverts being disregarded, as they represent a very small percentage, and have averaged less than the bid.

TOTAL QUANTITIES IN LINEAL FEET.

Section.	Tunnel.	Conduit.	Total.
1	19,636	23,809	43,445
2	21,332	5,326	26,658
3	22,830	10,088	32,918
All	63,798	39,223	103,021

CONTRACTOR'S BID.

Completed and Lined Tunnels.

Section.	Feet.	Rate Per Ft.	Total.
1	19,636	$22.50	$441,800.00
2	21,332	36.70	782,884.40
3	22,830	33.30	760,239.00
All	63,798	Average $31.11	$1,984,923.40

Conduit Excavation.

Section	Feet.	Aver. Yardage.	Price Per C.Y.	Total.
1	23,809	5.9	$1.066	$149,744.32
2	5,326	5.2	1.625	45,004.70
3	10,088	5.0	1.175	59,267.00
All	39,223	Average	$6.48*	$254,016.02

Conduit Lining and Cover.

Section.	Feet.	Rate Per Lin. Ft.	Total.
1	23,809	$6.721	$160,020.29
2	5,326	7.00	37,282.00
3	10,088	6.876	69,363.09
All	39,223	Average $6.80	$266,665.38

*Cost per lin. ft.

Under the specifications, cement, tunnel timbers, and reinforcing steel were to be furnished to the contractor free, at the nearest railroad station. This represents a cost to the city as follows:

Cement, per lineal foot of tunnel and conduit	$2.70
Tunnel timbers, per lineal foot of tunnel	.62
Steel, per lineal foot of conduit	.27

In case the work had been let by contract, it would have been necessary to maintain an engineering staff with clerks and inspectors, at the expense of the city, for the period of two and one-half years involved in the contract. This cost would have been $3,715 per month, equal to a total of $111,450, or an average cost per foot of aqueduct of $1.08. The total cost of engineering and supervision, under the force account system adopted, is included in the unit costs given.

ESTIMATED COST OF WORK TO CITY OF LOS ANGELES, IF DONE BY CONTRACT.

Tunnels.

Bid per foot completed	$31.11
Timbers per foot	.62
Cement per foot	2.70
Engineering and inspection	1.08
Total per foot	$35.51

Conduit

Bid—Excavation per foot	$ 6.48
Lining per foot	6.80
Cement per foot	2.70
Steel per foot	.27
Engineering and inspection	1.08
Total per foot	$17.33

Above costs do not allow anything for depreciation on instruments and equipment used by the city on this work.

ACTUAL COST BY FORCE ACCOUNT.

The total amount of work to be done, and footage completed to January 1, 1910, is as follows:

	Total Footage, Feet.	Amount Done, Feet.	Pct Done.
Tunnel excavation	63,798	61,515	96½
Tunnel lining	63,798	33,805	53
Conduit excavation	39,223	33,868	86
Conduit lining	39,223	16,100	41

Detail of Tunnels.

	Total Expended.	Amount Built, Ft.	Unit Cost.
Excavation and timbering	$780,360.00	61,515	$12.70
Lining	229,727.00	33,805	6.80
Total per foot of completed tunnel			$19.50

Detail of Conduit.

	Total Expended.	Amount Built, Ft.	Unit Cost.
Excavation	$121,521.50	33,868	$ 3.60
Lining	117,761.50	16,100	7.30
Total per foot of completed conduit			$10.90

EQUIPMENT, PIPE LINES, ETC., FOR THE ENTIRE FOOTAGE.

Miscellaneous equipment, exclusive of compressor plants, main pipe lines, main telephone lines and roads	$150,000.00
Branch pipe lines, total cost	20,000.00
Local telephone system, total cost	4,000.00
Buildings, including wiring for lights	53,000.00
	$227,000.00

Assuming no salvage on this plant, we have $227,000 divided by 103,021 equals $2.20, average cost per foot for entire division.

MAINTENANCE AND OPERATION TO JAN. 1

The general maintenance and operation charges on water supply, roads, telephones and division administration, amounts to 3½ per cent of total construction charges, or 68 cents per foot for tunnels and 38 cents per foot for conduit. The charges for the field engineering and supervision are included in the construction costs given.

TOTAL COSTS BY FORCE ACCOUNT.

Tunnels.

Excavation	$12.70
Lining	6.80
Maintenance and operation	.68
Equipment	2.20
Total	$22.38

Conduit.

Excavation	$ 3.60
Lining	7.30
Maintenance and operation	.38
Equipment	2.20
Total	$13.48

COMPARISON.

Tunnels—Cost by contract	$35.51
Tunnels—City costs	22.38
Saving per foot	$13.13
Conduit—Cost by Contract	$17.33
Conduit—City costs	13.48
	$3.85
63,798 feet x $13.13	$837,667.00
39,223 feet x 3.85	151,008.00
Estimated total saving on Jawbone Division	$988,675.00

This estimated saving is conservative, as the work to be completed will cost less per unit than that done previously, owing to the nature of the ground and the im-

provement in the organization. Salvage values of plant, also extra work which we have done and charged to construction (which would have been billed as "extra work" by the contractor) would have a tendency to increase this estimate.

One of the most advantageous features of force account work is the opportunity that it affords to make changes in the location of the line or in the design of the various structures, things which are very difficult to do when a municipality is bound by rigid contract. The economic studies that are made as the work progresses constantly offer suggestions for a change in route or changes in the detail location. The character of the materials which are encountered frequently demands a complete change in the design of a structure to be built. It is thus possible, under force contract with good cost-keeping, to obtain the most economical results and the most stable work.

This change in construction is vividly illustrated by the fact that the first location of our line called for 28 miles of tunnels, whereas the line as it is now being built will contain 43 miles of tunnels.

J. B. LIPPINCOTT.
Chief Engineer Los Angeles Aqueduct.

Cost of Asphalt Repairs in Brooklyn.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Complying with your request I am forwarding you herewith copy of report of the operations of the Municipal Asphalt Plant for the year 1909.

JOHN C. SHERIDAN, Chief Engineer,
Bureau of Highways,
Brooklyn, N. Y.

The report goes into detail of costs of items and classes of items and unit costs. On account of lack of space, the analysis of costs and the summaries only are given in the following extracts from the report:

The Brooklyn Municipal Asphalt Repair Plant is located on the 7th St. Basin of the Gowanus Canal, near 2d Ave. It has a capacity of 270 cubic feet of wearing surface, and 100 cubic feet of binder per hour, and is equipped with self-contained rotary driers, two of which are used for heating sand, and one for binder-stone. The cylinders of these driers are 40 inches in diameter, 19 feet 6 inches long, with longitudinal vanes. Each set is so arranged that they may be driven independently or at the same time. The driers discharge into an elevator, fitted with 10-inch by 6-inch buckets, which convey the material to the respective storage bins above the mixing boxes, whence the material is drawn by gravity into the weighing boxes, which rest on platform scales, so that each batch of material can be accurately weighed. These scales are fitted with double beams, so that the amount of dust used in each batch of wearing surface may also be accurately weighed with the sand. The weighing boxes discharge into the mixers, which have a capacity of 9 cubic feet of wearing surface mixture, and 10½ cubic feet binder. The mixers discharge by gravity into trucks driven directly underneath, and are so arranged as to permit of running out both top and binder simultaneously.

There are three melting tanks of 1,500 gallons each, enclosed, and capable of withstanding 15 pounds pressure, and equipped with mechanical agitators. These tanks are so arranged that any of the three, or all of them, may be used for the asphaltic cement supply to either one or both of the mixers. The asphaltic cement is fed into the weighing buckets by air pressure through standpipes from the bottom of each tank, rising above the level of the mixing floor, so as to properly discharge into the weighing buckets, which run on overhead trolleys, and are equipped with double beam scales.

The power plant has a 60-horse power, water tube boiler, Babcock and Wilcox Co. The plant is driven by a 10-inch by 12-inch automatic cut-off center crank engine, manufactured by the Erie Engine Works, Erie, Pa. Since it is desirable to have the power for agitating the tanks independent from the main engine, so that the tanks may be charged and agitated without running the rest of the plant, there is also a 5-inch by 5-inch vertical automatic cut-off engine, 9-horse power.

Report of Costs and Operation of Municipal Asphalt Plant for the year ending Dec. 31, 1909, and Costs of Maintenance of Asphalt Pavement in the Borough of Brooklyn, New York City:

Plant value Jan. 1, 1909.....	$41,016.10
Betterments during 1909.....	824.82
	$41,840.92

FIXED CHARGES.

Interest on payments on betterments at 5 per cent.....	$ 9.32
Interest at 5 per cent and depreciation on plant at 10 per cent. for one year on $41,016.10	6,152.41
Rent of plant and grounds....	1,440.00
Taxes for 1909.....	608.23
Total fixed charges.....	$ 8,209.96

PLANT PRODUCT.

18,082 boxes wearing surface mixture, each 8.75 cu. ft...	158,217.50
5,031 boxes binder, each 9.00 cu. ft.	45,279.00
23,113 boxes total plant product, cu. ft.	203,496.50

SUMMARY OF EXPENDITURES.

General supervision		$ 2,543.27
Fixed Charges		8,209.96
Total		$10,753.23
General Expense:		
Supplies, Coal		$ 2,608.37
Wood		1,333.08
Oil, Grease, etc.		635.58
Cement (sweeping surface)		91.11
Superintendent's Automobile (operation		1,778.66
Dumping Privilege		1,355.65
Repairs to Plant		2,092.22
Repairs to Tools		1,144.35
Total		$11,039.02
Materials:		
18,082 Boxes (9 cu. ft.) wearing surface mixture: 1,420,854 lbs. Refined Asphalt at $23.50		$16,695.03
154,586 lbs. Refined Asphalt at $25.00		1,932.32
Total		$18,627.35
525.00 gals. Residuum Oil at $.07 3-8		$ 38.68
18,609.08 gals. Residuum Oil at $.09		1,674 82
		$ 1,713.50
Less credit on 444 empty bbls. returned at $ .50		222.00
		$ 1,491.50
264.925 Tons Stone Dust at 2.84		$ 752.38
192.2 Tons Stone Dust at $3.15		605.42
Tons, labor unloading		50.53
		$ 1,408.33
1,015 cu. yds. sand at $ .85		$ 862.75
6,166 cu. yds. sand at $ .87		5,364.42
		$ 6,227.17
Total cost wearing surface materials		$27,754.35
		$49,456.60
Materials:		
5,031 boxes (9 cu. ft.) binder mixture:		
144,484 lbs. refined asphalt at $23.50	$ 1,697.69	
16,000 lbs refined asphalt at $25.00	200.00	
	$ 1,897.69	
1,950 gals, flux at 9c	175.50	
601.5 cu. yds. binder stone at $1.40	842.10	
1,339 cu. yds. binder stone at $1.14	1,526.46	
	$ 2,368.56	
Total cost binder materials		$ 4,441.75
Concrete Materials:		
774 cu. yds. stone at 1.00	774.00	
1,372 lbs. cement at 1.25	1,715.00	
77 cu. yds. sand at 75c	57.75	
501 cu. yds. sand at 45c	225.45	
23 cu. yds. sand at $1.00	23.00	
Total cost concrete materials		$ 2,795.20
Plant Labor:		
Foremen, 300.25 days at $6.00	1,801.50	
Foremen, 69.25 days, at $4.00	277.00	
Engineers, 461.59 days, at $4.50	2,077.17	
Stokers, 966.86 days, at $3.00	2,900.58	
Asphalt workers, 4,100.89 days, at $2.50	10,252.23	
Laborers, 689.25 days, at $2.50	1,723.12	
Clerk, 6 days, at $2,100	40.38	
Total	$19,071.98	
Street Labor:		
Foremen, 2,341.04 days, at $4.00	9,364.17	
Engineers, 1,587.30 days, at $4.50	7,142.84	
Asphalt workers, 13,678.05 days, at $2.50	34,144.60	
Asphalt workers, 5,699 days, at $2.00	11,398.00	
Laborers, 68.50 days, at $2.00	137.00	
	$62,186.61.	
Trucking:		
Teams and trucks, 2,884.747 days, at $6.00	17,308.48	
Total cost labor and trucking		$ 98,567.07
Grand total of costs		$155,350.62

CURRENT INFORMATION

Good Government Pays—Municipal Garbage Collection—Cement in 1909—Passaic Valley Intercepter

Good Government Pays in Memphis.

One of the arguments advanced by the National Municipal League for the selection of right-minded public officers is that "it pays," and in proof thereof is the administration recently closed of James H. Malone, mayor of Memphis. Some of the things accomplished during his administration were:

Sixty miles of streets permanently paved; the construction of certain subways and the passage of ordinances for the construction of others, to eliminate railroad grade crossings; the development of the greatest park system in the South; the expansion of the artesian water system, now worth twice as much as the city paid for it; the extension of the city limits; the doubling of the fund for school purposes; the improvement of the health department until Memphis now ranks third among the cities of the United States in point of health; radical reforms in the methods and results of the city court, and the increase in the revenue, the improvement in the keeping of accounts of the city and in the collecting of revenue.

While all of these things have been accomplished, the tax rate actually was lowered during Mayor Malone's term from as high as $2.88 in the prior administration to $1.76 in 1909. When he entered office, the city's current debt was $200,000; when he retired, the city was doing business upon a cash basis and had no unpaid accounts. Memphis increased its property valuations from $66,000,000 to $84,000,000, with a great increase in population.

Cement Production in 1909.

The following preliminary estimate of the production of cements in the United States in the year 1909 has been prepared by Ernest F. Burchard, of the United States Geological Survey. The annual statistics of the mineral production of the United States are ordinarily collected by the Geological Survey only, but those for 1909 are being collected by the Survey in co-operation with the Bureau of the Census, in order to avoid annoyance to miners, manufacturers, and others by duplicate requests from government bureaus. This co-operative arrangement will necessarily result in considerable delay in the publication of the report on the cement industry for 1909 and for that reason many manufacturers requested the Survey to collect the data on cement in the usual manner. The Director of the Census approved the course requested, and accordingly the usual inquiries were sent by the Survey to cement producers. Owing to the conditions stated, these requests were sent out more than two months later than last year, but replies have now been received from about 88 per cent of the Portland cement companies in the United States.

As shown by the quantities reported in the replies received, to which has been added the estimated output of the small number of producers who have not yet responded, the production of Portland cement in 1909 was between 61,300,000 barrels and 62,000,000 barrels, which, valued at 85 cents a barrel, was worth at the mills between $52,105,000 and $52,700,000. This represents an increase in quantity of at least 10,227,000 barrels and in value of at least $8,557,000 over the production in 1908, which amounted to 51,072,612 barrels, valued at $43,547,679. The increase in quantity was therefore at least 20 per cent. over that of 1908. The reported selling price per barrel averaged the same as in 1908—about 85 cents—although Portland cement was sold during the summer of 1909 at a figure so low as to cause a general expectation that the average price for the year would fall below that of 1908.

The returns for the production of natural cement are not yet quite so complete as those for Portland cement, but they indicate that the total production in 1909 was not far from 1,500,000 barrels, valued at about $675,000, an average value of 45 cents a barrel. These figures show a slight decrease as compared with those for 1908, when the production was 1,686,000 barrels, valued at $834,509.

The production of puzzolan cement, as reported, shows a slight increase, about 160,646 barrels, valued at $99,453, having been produced in 1909, as compared with 151,451 bzarrels, valued at $95,468, in 1908.

The details of manufacturing developments and trade conditions will be discussed in the annual report of the survey on the cement industry, which is now in preparation as a chapter of the volume on "Mineral resources of the United States, calendar year 1909."

Objections to Passaic Valley Intercepter Withdrawn.

The action of Attorney-General Wickersham, May 3, in signing the stipulation under the terms of which the United

States withdraws its objection to the building of the Passaic Valley intercepting sewer, probably marks the destruction of the last serious obstacle or delay in the actual construction of the big drain. It is thought that the work of building the big flume will require about four years. It will be 26¼ miles long and will cost about $12,250,000.

Municipal Garbage Collection Proposed for Washington, D. C.

Abandonment of the present method of collecting garbage, ashes and refuse in the District of Columbia, was the purport of a bill introduced May 6 by Representative Cary, of Wisconsin, and proposing "that instead of having this work done under contract system it be taken charge of and directly disposed of under the direction of the superintendent of the street cleaning department of the District of Columbia."

Mr. Cary had previously introduced a resolution calling for an investigation of the local health department, on the ground that there is too much delay in the collection of garbage and rubbish of all kinds.

ORGANIZATIONS AND INDIVIDUALS

American Water Works Convention—American Highway League—Technical Meetings—Civil Service—Technical Schools—Our New Eastern Manager—Personal Notes.

American Water Works Convention.

The thirteenth annual convention of the American Water Works Association was held in New Orleans, La., April 26 to 30. The presentation of fewer papers this years than in former years was regarded generally as advantageous, and as a whole the convention was considered very successful. Among the papers were the following: "Electricity in Water Works Pumping," by Charles P. Burdick, of Chicago; "Municipal Improvements at New Orleans," George S. Earle, general superintendent of New Orleans water and sewerage board; "Water Meters," H. B. Rudisill, of Anniston, Ala., and A. W. Cuddeback, of Paterson, N. J.; "The Springfield Water Works," Allen Hazen, ficers were re-elected at the annual meet- New York City; "Conservation of Potable Waters," Secretary Diven; "The Cost of Furnishing Water," Daniel W. Mead, of Chicago, and Madison, Wis.; "A Co-operation Water Works Franchise," John W. Alvord; "Municipal Ownership," Park Woodward; "Fire Service Water Works. Winnipeg, Man.," H. N. Ruttan, of Winnipeg; "Creosoting Algae," Mr. Willcox, of Meridian, Miss.; "Pipes Under Railway Tracks," Willis B. Durlin; "Formulas for Making Water Rates," J. W. Ledoux; "Assessments for Water Main Extensions," Mr. Spaulding, of Springfield, Ill.; "Danger of Water Contamination Where Special Fire Services and City Mains are Interconnected," Alex Milne, of St. Catharines, Ont.; "Water Softening at McKeesport, Pa., and Winnipeg, Man.," Alexander Potter, of New York City; "Water Works Advertising," Dow R. Gwin, president of Terre Haute Water Works Co., Terre Haute, Ind.; "Operation of the Settling Basins, Richmond, Va.," E. E. Davis, of Richmond.

Committee reports were submitted as follows: "Electrolysis," Dabney H. Maury, chairman; "Depreciation," John W. Alvord, chairman; "Uniform Accounts and Reports," Albert H. Wehr, chairman; "Finance," H. A. Kecler, chairman; "Reorganization," Dabney H. Maury, chairman; "Fire Protection" and "Water Works Standards," Charles A. Hague, chairman.

John W. Alvord, of Chicago, was elected president, and John M. Diven was re-elected secretary and treasurer. The next convention will be held in Rochester, N. Y., in 1911.

American Highway League.

Representatives of twenty-five states met in a convention held in Chicago May 13 and 14, to take preliminary steps towards organizing a national highway commissioners association. The name adopted is the American Highway League and its purpose is to study and discuss methods of highway administration, construction and maintenance; to secure effective co-operation between state highway departments interested in highway improvement. A. N. Johnson, M. Am. Soc. C. E., state highway engineer,

Springfield, Ill., was elected president, and Thomas H. MacDonald, state highway engineer, Ames, Ia., secretary. Mr. Johnson gave a talk on modern methods of macadam highway improvement, illustrated by stereopticon views. A special committee, with W. W. Crosby, chief engineer of the Maryland Highway Commission, as chairman, was appointed to obtain records and reliable statistics as to the wear and general efficiency of macadam treated in various ways and with various materials. Other subjects discussed were the following: (1) Highway bridges, particularly in regard to concrete structures and the work done by local contractors having little experience in this particular line; (2) standardizing specifications for road and bridge work; (3) guarantee bonds for paving and roads, with the view to abandoning the use of such bonds (which are usually impossible of collection or enforcement) or modifying them in such a way that they may be made effective; (4) highway administration, and the remedy of difficulties in the proper expenditure of road and bridge taxes in districts under other than municipal control; (5) the use of convict labor; (6) brick paving for highways (this is in use to a considerable extent in Ohio and has been tried elsewhere).

The latest number of the proceedings of the Merchants' Association of New York contains a brief appreciation of Walter C. Kerr, the late president of Westinghouse, Church, Kerr & Co. It also contains a preliminary report on the capital, earnings and rates of the express companies of the United States, and reports of the many valuable investigations and agitations which the association has instituted.

Technical Meetings.

A good roads convention will be held in Billings, Mont., June 16, 17 and 18, for the purpose of discussing ways and means for the improvement of the public highways of Montana, and to awaken a more general interest in that state in road building and improvement. The executive committee is composed of the following men: W. B. George, I. D. O'Donnell, P. B. Moss, W. S. Garnsey, H. W. Rowley, J. Collins West, E. B. Campbell, Christian Yegen, R. E. Shepherd and W. A. Selvidge, of Billings; W. M. Bickford and F. C. Largey, of Butte; J. C. McCarthy, of Bozeman; Frank M. Smith, of Helena; W. R. Allen, of Anaconda; A. W. Miles, of Livingston; W. A. Talmage, of Red Lodge; J. M. Keith, of Missoula, and C. F. Murphy, of Great Falls.

The American Water Works Association will meet in Rochester, N. Y., in 1911.

The annual convention of the Engineers' Society of Pennsylvania will be held at Harrisburg, Pa., June 1, 2, 3 and 4. E. R. Dasher, sec'y, Gilbert Bldg., Harrisburg.

The annual convention of the American Society of Civil Engineers will be held at Chicago, Ill., June 21, 22, 23 and 24. Chas. W. Hunt, sec'y, 220 W. 57th st., New York City.

The annual meeting of the Society for the Promotion of Engineering Education will be held at Madison, Wis., June 23, 24 and 25. Henry H. Norris, sec'y, Cornell University, Ithaca, N. Y.

The annual convention of the American Institute of Electrical Engineers will be held at Jefferson, N. H., June 27, 28, 29 and 30. R. W. Pope, sec'y, 33 W. 39th st., New York City.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 28, 29, 30, July 1 and 2. Edgar Marburg, sec'y, University of Pennsylvania, Philadelphia.

At the meeting of the Municipal Engineers of the City of New York, held May 25, Benjamin C. Marsh, secretary of the committee on congestion of population read a paper on "Economic Aspects of City Planning." A trip to Schenectady, Albany and Troy was made, leaving New York Friday night, May 27. On Saturday, June 4, an inspection will be made of the Erie Railroad improvements in Jersey City.

The proceedings of the sixteenth annual convention of the American Society of Municipal Improvements, held at Little Rock, Ark., last November, have just been issued in a well-illustrated volume of 432 pages. The next convention will be held in Erie, Pa., in November, 1910.

The Committee on Congestion of Population in New York, Prof. Frank J. Goodnow, chairman, has issued an interesting pamphlet giving "The True Story of the Worst Congestion in Any Civilized City."

President H. D. Sexton, of the East Side Levee and Sanitary District, East St. Louis, Ill., has issued the first report of its work, showing details of plans and of work thus far accomplished.

Edward M. Bassett, one of the Public Service Commissioners of the First District in New York, has submitted a valuable report on grade crossings in New York City and the need of change in the grade crossing law.

The second international road congress will be held in Brussels, Belgium, July 31 to August 7, 1910. The work of the convention will be divided into two subdivisions, one on construction and maintenance of pavements and roads in the large towns, and one on the same outside of such towns. Among the special papers are several on gasoline and steam motor rollers, road making tools, materials, sidewalks, removal of snow and ice, influence of weight and speed of traffic on bridges, relations of weight, speed and mode of propulsion on road wear, road signs, soft tires, statistics of traffic. The general subjects for discussion include comparisons of metalled and paved roads, binding

materials, foundations, drainage, construction details, light railways and tramways in roads, cleaning and watering, choice of pavement, etc. The American Road Builders' Association, 150 Nassau street, New York, has appointed a committee to organize a delegation from the United States, and the secretary, E. L. Powers, wishes to hear from those who propose to attend.

The American Museum of Safety now has an exhibit hall for devices to prevent accidents in the Engineering Societies Building, 29 W. 39th street, New York City.

The February number of the journal of the American Society of Engineering Contractors contains the papers presented at the special convention held in Chicago. The association recently held its annual election of officers, which resulted in the re-election of the former list of officers. D. E. Baxter is president and Daniel J. Hauer is secretary, 13-21 Park Row, New York City. Indiana has the first local branch, with Ralph M. Snyder, of Fort Wayne, as president, and Charles C. Brown, of Indianapolis, as secretary.

The National Fire Protection Association met in Chicago, May 17, 18 and 19, and heard reports from the numerous committees to which the work of the association is assigned, and also addresses by Irving K. Pond, president of the American Institute of Architects, on "The Architect and Fire Protection," and F. S. Baker, president of the Royal Architectural Institute of Canada, on "Fire Insurance versus Preventive Measures in Building." Delegates to conventions of other associations also reported.

The second national conference on city planning and the problems of congestion, held at Rochester, N. Y., May 2 to 4, followed the program outlined last month and did much valuable work.

The Cement Products Exhibition Co. reports the cost of the great Chicago cement show to have been $41,721.65, and the company has the uncomfortably small balance of $785.08 on hand. The old offing, Edward M. Hagar being president, J. U. C. McDaniel, secretary and treasurer, and B. F. Affleck, chairman of the executive committee.

The year book of the Civic League of St. Louis contains lists of members, officers and committees, Harry Pratt Judson's address at the annual meeting on "Civic Righteousness," the president's statement, and reports from the league's committees on all lines of its work.

At the meeting on May 11 of the New York Electrical Society, T. Thorne Baker, of London, Eng., lectured on "The Transmission of Photographs, Wireless and by Wire."

At the meeting of the Brooklyn Engineers' Club, May 12, Richard L. Russell read a paper on "Contractors' Cost Keeping and Organization," describing methods and showing typical record forms. The club inspected the new Pennsylvania Railroad's New York City terminal, electric locomotives and tunnel.

The International Exhibition of Railways and Transport, at Buenos Aires, has opened and will continue until November. The exhibition buildings were most of them completed well in advance.

The next tournament of the Wisconsin State Firemen's Association will be held at South Milwaukee, June 22, 23 and 24. J. H. O'Connell, corresponding secretary, South Milwaukee.

The convention of the International Association of Fire Engineers will be held at Syracuse, N. Y., August 23, 24, 25 and 26. James McFall, secretary, Roanoke, Va.

The Louisiana State Firemen's Association held its annual convention at Lafayette, May 27, 28 and 29.

The International Association of Chiefs of Police will hold its convention in Rochester, N. Y., during the month of June. Harvey O. Carr, secretary, Grand Rapids, Mich.

The Association of Chiefs of Police of Ohio will meet at Chillicothe in August.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places on June 15 for men to fill at least fifty vacancies in positions as surveyors at $1,400 a year in the Philippine service.

The Technical Schools.

The new building for the engineering department of Union College was dedicated on April 28 with appropriate exercises, including an address on "The Limitations of Efficiency in Engineering Education," by Prof. Geo. F. Swain, of Harvard University, one by Edward W. Bemis, deputy water commissioner in New York City, on the training needed for engineers in the public service, and formal speeches by Dr. Andrew S. Draper, State Commissioner of Education; Dr. Franklin H. Giddings, of Columbia University, and President Garfield, of Williams College.

The February bulletin of Purdue University, just issued, contains the annual catalog for 1909-10.

"A Study in Heat Transmission," by J. K. Clement and C. M. Garland, is issued as Bulletin No. 40 of the Engineering Experiment Station of the University of Illinois. The bulletin describes a method of studying the effect of the agitation of a medium in contact with metal walls upon the heat conducted through these walls and to or from the medium. Results of experiments upon the heat transmitted to water as the medium in contact with the walls of a tube, under varying velocities or rates of agitation, are given.

The Stevens Institute of Technology, Hoboken, N. J., is asking from Congress the return of $45,750 (with interest)

promptly paid by the institute in accordance with a law requiring such payment as a tax on the Stevens bequest, whereas other institutions in similar condition delayed payment until a law could be passed relieving them of the tax, so that the institute suffers from its promptness in paying its bills.

Bulletin No. 216, of the University of Wisconsin, contains the first report of investigations made of the flow of water through large submerged orifices and tubes. This volume contains descriptions of experiments and statements of results with tubes 4 feet square, by Clinton Brown Stewart, C. E., and makes some important additions to our knowledge of this subject.

"Tests of Washed Grades of Illinois Coal," by C. S. McGovney, is issued as Bulletin No. 39 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of an elaborate series of boiler tests made in connection with a 210-horse-power brick-set water-tube boiler, equipped with a chain grate stoker. The fuel employed was washed Illinois coal of the various sizes commonly used for steam purposes. The description of the plant, the methods employed and the results of the tests are given in detail.

The University of Tennessee, Knoxville, has issued the thirteenth edition of its little book of "Tables and Other Data for Engineers and Business Men," which is compiled by Prof. Chas. E. Ferris, and is a convenient compendium of the most commonly used tables in civil and mechanical engineering and business, and of information about the university. It costs 50 cents.

A late issue of *The Tech,* published at the Massachusetts Institute of Technology, Boston, contains a history of the department of civil engineering and sketches of the courses and of the professors in charge of them, illustrated by their portraits.

Our New Eastern Manager.

We wish to announce the recent appointment of Mr. B. E. Mitler to the position of Eastern manager of the Municipal Engineering Co. He now has charge of our Eastern office at No. 1 Broadway, New York City.

For the past four and a half years Mr. Mitler has been actively engaged in the technical publishing field with the McGraw Co., of New York, publishers of *Engineering Record, Electric Railway Journal* and *Electrical World.*

We shall be glad to have our friends in the Eastern territory confer with him whenever they desire information relative to the municipal field.

Personal Notes.

Hon. Lee Offutt has been elected mayor at Rockville, Md.

Robert E. Joyce has been elected mayor at Mt. Rainier, Md.

Carl E. Plum has been reappointed city engineer at Elgin, Ill.

Martin A. Feeney has resigned as city engineer of Butte, Mont.

Clarence B. Wilson has been elected mayor at Glen Echo, Md.

Hon. E. D. Kingsley has been re-elected mayor at Gaithersburg, Md.

Hon. John A. Cannon has been re-elected mayor at Kensington, Md.

H. G. Lykken has been appointed city engineer at Grand Forks, N. D.

Hon. William P. Magruder has been re-elected mayor at Hyattsville, Md.

W. K. Greenwood, of Toronto, Ont., has been appointed town engineer of Orillia, Ont.

George Retting has been appointed superintendent of city forestry at Cleveland, O.

Maurice H. Thatcher has been appointed a member of the Isthmian Canal Commission.

The Sargent Steam Meter Co., Chicago, Ill., has moved its office and laboratory to 153-158 Lake st.

Frank C. Kelsey has resigned from the Nisqually water power project for the city of Tacoma, Wash.

F. K. Rader has been placed in charge of the engineering work of the park department at Atlanta, Ga.

William G. Platt has been re-elected mayor, and L. R. Grabill, R. D. Rush and H. F. Taff, councilmen, at Takoma Park, Md.

J. R. Preber has been appointed chief engineer to take charge of the new Green river water supply system for Tacoma, Wash.

Charles Lyon McIntosh, treasurer of the J. I. Case Threshing Machine Co., of Racine, Wis., died at Naples, Italy, April 19.

John L. Ray, superintendent of the Calais division of the Maine Water Co., died at his home in Milltown, N. B., after a short illness.

William Storrs MacHarg, M. Am. Soc. C. E., consulting engineer of the Chicago department of public works, died May 6, aged 63 years.

J. J. Brooks, Jr., general sales manager of the Harbison-Walker Refractories Co., Pittsburg, Pa., has been elected to its directorate.

Prof. Arthur H. Blanchard, of Brown University, has recently been elected a member of the Societe des Ingenieurs Civils de France.

The Standard Bitulithic Co. has removed its offices to the Hudson Terminal Building, 50 Church st., corner Fulton st., New York City.

Prof. J. C. Nagle, professor of civil engineering in the Agricultural and Mechanical College of Texas, has been appointed city engineer of Bryan, Tex.

H. V. Joslin has been appointed assistant engineer in connection with the investigation now under way for a new water supply for Norfolk, Va.

The A. W. Erickson Advertising Agency has moved its offices from 127 Duane st. to the Fourth Ave. Building, Fourth ave., corner 27th st., New York City.

Alton D. Adams, Worcester, Mass., has been employed by the city of Binghamton, N. Y., to report on the development of a water power on the Susquehanna river

and the cost and operating expenses of an electric plant for municipal lighting.

Hon. John Wesley Stone has been re-elected mayor at Garrett Park, Md.

A. H. Dahlow, Francis Gasch, John Haynes, Marion Duckett and Frederick Hiller have been re-elected members of the town board at Bladensburg, Md.

Bernard J. Mullaney, formerly secretary to Mayor Busse, of Chicago, has been appointed commissioner of public works, to succeed John J. Hanberg, resigned.

John E. McKay, who has been continuously in the service of various engineering departments of New York City since 1872, died at White Plains, N. Y., May 12.

W. P. Cowler has been appointed resident engineer of the Minneapolis civic commission, which is studying, under the direction of E. H. Bennett, of Chicago, a civic improvement plan for Minneapolis.

G. R. Ellis has been appointed city engineer of Columbia, Mo., succeeding D. B. Duncan, who resigned to become a member of the contracting firm of Davis & Duncan.

James R. Marker has been appointed chief engineer of the Ohio state board of public works, at Columbus, O., succeeding Charles E. Perkins, who held the position for 18 years.

William T. S. Curtis has been elected president, and G. W. F. Swartzel, Vernon E. Hodges, A. A. Hoehling and John L. Weaver, members of the board of trustees at Chevy Chase, Md.

MACHINERY AND TRADE

The Snell Open-Drum Concrete Mixer.

The distinctive feature of the Snell concrete mixer is the drum. In the smaller sizes it is cylindrical and made in one piece. In the larger sizes a truncated cone is added to reduce the space on which the mixture is discharged. The joints are thoroughly riveted and are water-tight. The interior of the drum is perfectly smooth except for five small parallel blades riveted to the drum at right angles with the bottom. There are therefore no pockets or interior mechanism to be clogged with concrete.

The drum is mounted on a cast iron pan, which forms its bottom, and carries the gearing for revolving the drum. The whole drum rests on one ball bearing in the center of the cast iron bottom, as far from danger of damage from concrete as possible. The whole outer end of the drum is open.

The drum is operated by a gasoline engine through gearing, and is so mounted that it can be tilted from one side to the other. In some of the designs the drum is tilted to one side and the concrete materials are dumped from wheelbarrows or shoveled into it. Being only 36 inches from the ground, it is easy to arrange a platform for dumping in the materials with the least possible handling. The drum is revolved, and when in position for the best mixing its axis stands at an inclination of 45 degrees. The pouring process of the revolution and the blades mixes and kneads the aggregate at least a hundred times a minute, and the entire time of loading, mixing and dumping a batch is normally two minutes. When the mixture is complete the drum is tilted to the other side, still revolving, and the concrete drops out. The tilting mechanism in all but the smallest size of mixes is operated by a worm gear run by the engine, but can be operated by hand, the drum being so well balanced that it can be tilted with one hand. The tilting mechanism is operated from the loading platform, so that one man does the loading and discharging and can give full or partial discharge as desired, full discharge meaning a clean drum.

In some of the designs the loading platform is between the engine and the drum, the drum tilts toward the platform for filling and tilts to the opposite end of the truck for discharging.

The open drum makes inspection of the concrete easy, and so the thoroughness of the mixture and the amount of water can be judged to a nicety.

The various sizes are suited for heavy construction work, with batch of 18 cubic feet; for paving and sidewalk work, with batch of 10 cubic feet; for small contractors, with batch of 7 cubic feet, and a very small design, with batch of only 2½ cubic feet.

These mixers are made by the R. Z. Snell Manufacturing Co., South Bend, Ind., who will give any additional information desired.

Iron from Mine to Pipe.

The Lynchburg Foundry Co. have long been known as among the most progressive of the independent manufacturers of cast iron pipe. They have insured their independence by purchasing, through the Anniston Iron Corporation, which they control, the Woodstock iron properties at Anniston, Ala., with two blast furnaces, and the Milner Coal and Railway Co., at

Newcastle, Ala., with coal lands, coke ovens and facilities for mining a thousand tons of coal a day.

These properties will supply the foundries of the parent company with 50,000 tons of pig iron a day. The present plants at Lynchburg and Radford, Va., will be increased by a new plant at Norfolk, Va.

The 72-Inch Steel Pipe Line of the Brooklyn Water Supply.

The borough of Brooklyn, city of New York, takes its water supply from wells, infiltration galleries and ponds stretching over a distance of 23 miles along the south shore of Long Island and extending eastward to the Suffolk county line, about 30 miles east of the Borough Hall. The water is drawn from the wells, galleries and ponds by pumps in 24 isolated stations and delivered into large trunk mains.

It became apparent some years ago that further increase in the supply was necessary, and accordingly the Department of Water Supply, Gas and Electricity, having charge of the Brooklyn water system, determined on an increase in the number and capacities of its sources and pumping stations, and in the means of bringing the additional supply to Ridgewood reservoir, which is the main distributing center of the city distribution system. The new trunk main decided upon was a 72-inch steel pipe 24½ miles long, to be operated as a force main delivering direct to the distribution system and discharging the excess supply by an overflow connection into Ridgewood reservoir. Its capacity will be from 50,000,000 to 60,000,000 gallons per day.

The line extends from Valley Stream eastward to the Suffolk county line, in general parallel with and a short distance away from the right of way of the Montauk division of the Long Island Railroad. It is laid on a private right of way, in some places 100 feet and in others 200 feet wide. Being a pressure pipe, it is not laid on a gravity grade, the maximum gradient being 1 per cent. The maximum curve has a radius of 200 feet. In order to pass around curves the ends of the pipe are cut to a suitable bevel. The line consists of a circular steel plate pipe with an inside diameter of 72 inches, single-riveted circular joints and longitudinal joints made with "lock bar." It was manufactured by the East Jersey Pipe Co., at Paterson, N. J., for the contractors, T. A. Gillespie Co.

The pipe is made up in lengths of 30 feet, each weighing approximately 12,000 pounds and each length is coated while at a temperature of 350 to 400 degrees Fahr., with Sarco mineral rubber pipe coating.

The pipe coating specification was as follows:

After testing to the satisfaction of the commissioner of water supply, gas and electricity, or his authorized representative, the pipes shall be thoroughly cleaned and all grease, dirt, loose scale and rust removed, and then heated in a suitable oven to 350 to 400 degrees Fahrenheit, after which it is to be dipped vertically in a bath of mineral rubber pipe coating, equal to that manufactured by the Standard Asphalt and Rubber Co., of Chicago. This coating must be durable, smooth, hard, tough, perfectly water-proof and strongly adhesive to the metal, and must show no tendency to flow when exposed to the sun in summer, or to become so brittle as to scale in winter. It must be free from blisters and bubbles. The bath must be heated in such a manner as to insure a constant and even temperature of 400 degrees Fahrenheit. The coating shall be not less than 1-32 inch and not more than 1-16 inch thick, and must be a high resistant against electrolytic action. The material used for this coating must be shown by analysis to contain not less than 99.3 per cent. pure bitumen, consisting of not less than 70 per cent. petrolene (soluble in petroleum ether) and not more than 30 per cent. asphaltene (soluble in chloroform). The dipping material must be kept pure and free from sand, grit or other foreign material. To attain this, the contractor must, as often as it is necessary in the opinion of the engineer, empty the tanks of their contents, clean and refill them with pure material. The consistency of the material must also be kept uniform by the addition from time to time of suitable flux. Samples of the material proposed to be used for coating must be submitted to and approved by the commissioner of water supply, gas and electricity, or his authorized representatives.

Upon the completion of the riveting and calking, the seams are carefully painted with Sarco mineral rubber field coating, made from the same material with which the pipes are coated at the shop. When this work has been finished on a complete section from one line valve to another, the pipe is filled with water and tested to a pressure of 175 pounds per square inch, and upon being found tight the back-filling is commenced.

The contractor employed on the average, including the excavating, pipe-laying, riveting, calking and back-filling gangs, about 1,000 men. The contractor for the work is the T. A. Gillespie Co., of New York City, with Mr. M. J. Coffey, superintendent, in charge. The cast iron pipes for blow-offs and the cast iron specials were furnished by R. D. Wood & Co., Philadelphia, and the steel castings were supplied by the Taylor-Wilson Manufacturing Co., of McKees Rocks, Pa.

Mr. Walter E. Spear, chief engineer for the Department of Water Supply, Gas and Electricity, borough of Brooklyn, New York City, was in general charge of the work, and Mr. B. M. Wagner was division engineer directly in charge of construction.

Sarco mineral rubber pipe coating was supplied by the Standard Asphalt and Rubber Co., 205 La Salle street, Chicago, Ill.

The accompanying cut shows sections of the pipe on the line ready to lay.

SEVENTY-TWO-INCH STEEL PIPE OF BROOKLYN WATER WORKS.

From Valley Stream, Long Island, to Amityville, Long Island (City of New York.) Protected with Sarco Mineral Rubber Pipe Coating.

What Is Concrete Mixing?

The Chicago Cube Mixer Co. define mixing concrete as smearing or luting each particle of sand with cement paste and each particle of aggregate with mortar paste. Disintegration is not mixing. The mere fact of separating two particles and placing another between them does not constitute mixing, because to insure a perfectly intimate and homogeneous mixture, both pressure and grinding of the ingredients are required. To prove this, take a small pebble, say an inch or so in diameter, lay it down and pour water over it. Immediately, and before the water has time to dry, sprinkle cement over it until water is absorbed, and set it away to dry. The next day the cement can be lifted off in the form of a small cap. The reason for this is that the cement was not ground and pressed into actual contact with the pebble, the film of water effectually preventing contact of the two materials.

Cement paste is usually a very wet and sticky material. The only way that it can be made to cover the sand and aggregates is to rub the various particles together until each coarser particle is smeared with a paste of the next finer particles. Go into a testing laboratory and watch the expert there mixing cements and mortar pastes for test briquettes. An intimate and homogeneous mixture is above all things essential here. Note how it is secured. The operator has formed a small cone of sand and cement, with a crater in its top filled with water. With his fingers he folds the sides of the cone over into the water until the water is soaked up. Then he begins to mix. Arching his hands over the mass, he pulls it under the palms with his fingers, at the same time pressing the palms forward and downward, squeezing and grinding the particles together. The flattened cake is then folded up into a new cone and the mixing operation is repeated. This is an example of perfect mixing.

What the cement tester does with his hands and a few ounces of paste, the Chicago improved cube mixer does with its cubic yard or so mass of stone, sand, cement and water. The larger mass is not spooned or stirred any more than is the smaller mass; it is folded, refolded, squeezed and pressed into a homogeneous mass of mortar and cement-coated particles.

Almost any concrete looks good in the wheelbarrows, but in a test great variations in strength will be found. One of the reasons for this is that nearly all crushed stone, unless washed, is coated with a thin film of very fine dry dust. Nearly all gravel contains more or less clay or loam with which the coarser parts are covered. This dust, or coating of clay, positively must be ground away and the clean stone laid bare before the cement can get an actual contact with it. Mixers which act as disintegrators will not do this because the weight of the mass of ingredients is broken up into very small parts as it is separated and carried up inside the drum. In the Chicago improved cube mixer the batch is kept in one mass and the entire weight of the whole rests on the lower particles. As the entire batch is always in motion, each particle is constantly rubbing against some other particle as the mass is folded and refolded upon itself: there is a great crushing, grinding and kneading of the ingredients until every pebble or piece of stone is perfectly smeared with a coating of cement paste that is ground and squeezed into actual contact with a clean solid surface.

The Chicago Cube Mixer Co., Railway Exchange Building, Chicago, Ill., will send full information about the mixer.

Testing Laboratory Apparatus.

Chicago has a factory for the manufacture of laboratory apparatus for making tests of asphalt and cement, at 2014 Nebraska ave., operated by the Humboldt Manufacturing Co. Their price list contains the latest apparatus, some not elsewhere obtainable, including Kirschbraun's cementation and ductility machine, penetrometer, floor plate and briquette mold, all for asphalt, and all the standard apparatus for preparing cement for test for tensile and compressive strength, permeability, weight, specific gravity, fineness, etc.

Dryer and Heater for Broken Stone, Grit, Sand and Gravel.

The paving contractors, roofers and road builders of New York are this year using a new, economical and most convenient method of heating and drying their sand, grit, gravel and broken stone. Formerly this has been done in very crude ways, some sticking a cast iron pipe through a pile of gravel and making a fire therein, some placing the gravel on a flat iron plate raised from the ground on stones and building a fire thereunder. In either case much labor, patience, time and fuel were consumed, and very little gravel was dried and heated, for the gravel was never brought into a practical relation to the fire, and the fuel was mostly expended in heating the surrounding atmosphere instead of the gravel.

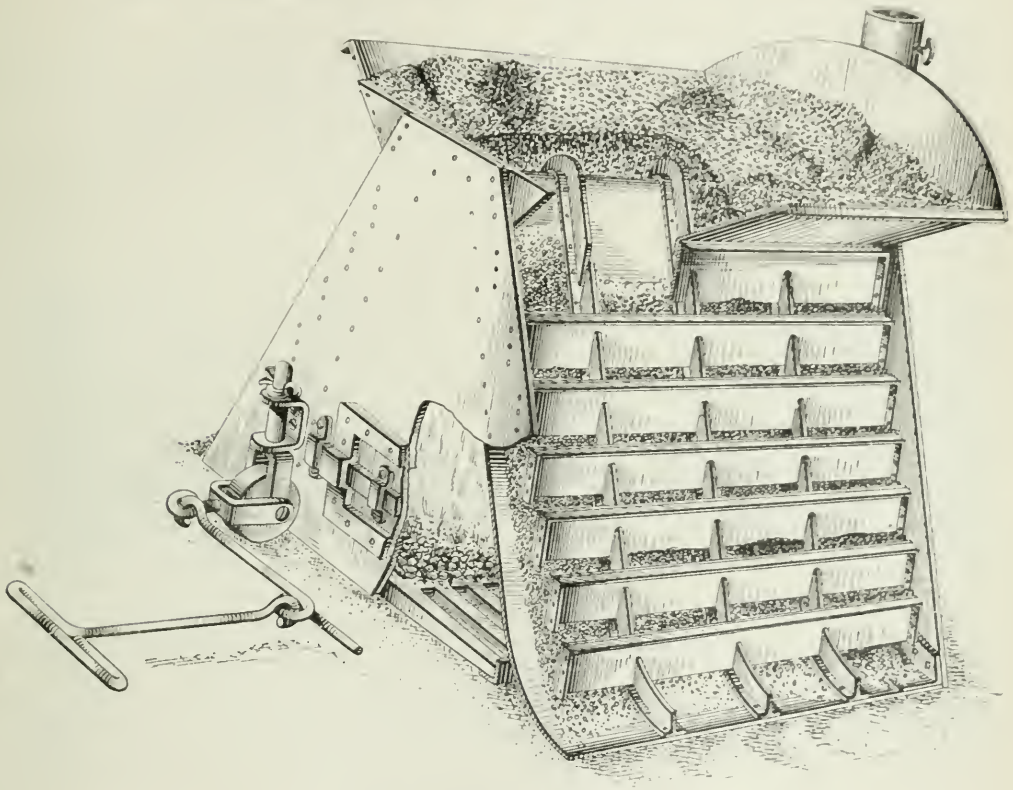
But one man is required to attend the machine now in use to supply hot dry gravel for a large gang. He builds and tends the fire, shovels cold wet gravel into the hopper above, and loads same into wheelbarrows, hot and dry, from the bottom of the heater, a few minutes later. This man does not need to work overtime.

It is surprising what a small amount of fuel is required to heat and dry a large amount of material. To understand the reason for this one must know the con-

struction of the apparatus, when it is readily seen that not one particle of heat escapes into the outer air without having done its work of drying and heating the gravel.

The structure, shown in the accompanying cut, is remarkably strong and simple. The furnace consists of a perforated sheet of metal bent over roof-like, to form the two heating sides, and solid end-plates, in which are fire door, flue, etc. There is a hopper above. Arranged down each perforated furnace side is a series of inwardly deflecting flights, also perforated through the perforations in the furnace sides, the voids in the about 4-inch layer of gravel held against same, and then out through the perforations in and the spaces between the inwardly deflecting flights. A more complete utilization of all the heat and products of combustion can hardly be imagined, for they cannot escape doing their work of drying and heating on their way out through the perforated sides and the voids of the gravel, and they have no means of escape except through these myriad tiny flues.

The efficiency of this idea is easily realized when one considers that cold wet gravel can be loaded into the machine, a fire built under it, and, in less than fifteen minutes, the first hot dry gravel is ready for use. After that it is a continuous process, the heater shown having a capacity of about five tons per hour or fifty tons per ten-hour working day, with one man tending the machine and a minimum consumption of fuel.



THE MULLEN GRAVEL HEATER.

rated. The gravel descends from the hopper into the space between the perforated furnace sides and the flights, where it is held in a thin layer while being dried and heated. When it is sufficiently hot and dry it is removed from the bottom of the heater, more gravel flowing in to take its place from the hopper above, thus forming a continuous process. The degree of temperature to which the material is heated can be easily regulated by the length of time it is allowed to remain in the heater and the amount of fuel used.

When the fire is well started, the damper in the flue is choked off. The draft and heat are thus forced to pass

It is claimed for this heater that it saves time, labor, fuel and money, is a very great convenience, and will pay for itself in less than three months.

Another invention is a combination tar-pot and gravel heater built along the

same lines. One of these was constructed especially for the Third Avenue Railroad Co., for use in repairing granite block pavement with tar and gravel joints along their rails on Forty-second street, near Broadway, New York City. It is believed that this newly introduced invention will prove of the greatest value to contractors doing roofing, paving and road building where it is necessary to heat and dry sand, gravel, broken stone or grit along the line of the work for instant use.

The inventions were made by Mr. Chas. A. Mullen, of New York City, himself a contractor, for years engaged in asphalt, bituminous and granite block paving work. He has made a systematic study of heating and drying coarse materials, of which the above described inventions, we are told, are but the first expression. His idea is to overcome the expensive and troublesome methods now in use at asphalt and other paving plants throughout the country. The Tide Water Iron Works, of Hoboken, N. J., are the sole licensed manufacturers.

The Shannon Sewer Cleaner.

The Shannon sewer cleaner was devised by contractors for daily use in their own work, and so it is a practical machine, directly suited to the demands made upon it. It consists of a trough with rounded, shovel-shaped ends, a movable cover and a flap valve.

To operate it a rope is passed through the sewer from one manhole to the next, and this rope passes through a pulley fixed at the bottom of the second manhole by means of a brace temporarily set in the sewer. This gives the opportunity for drawing the cleaner through the sewer from the first manhole to the second, by means of a windlass set on the street over the second manhole. When the cleaner has been drawn to the second manhole, the line which holds the pulley above mentioned is slackened off from above, allowing the pulley, cleaner and all to be hauled to the surface. The cover is then removed by drawing a couple of bolts and the cleaner is emptied into the attendant wagon or on the street. The cover is replaced and the cleaner is ready for another trip.

There are lugs on the cleaner which serve to keep it upright, and also to allow the cutting edge to pass over slight obstructions at pipe joints.

The complete outfit includes two windlasses and three special blocks with chains and shackles, so that the cleaner can work in both directions through the sewer, 600 feet of steel wire rope, with the necessary clamps, and four cleaners, one for 8 and 10-inch pipe, one for 12 and 15-inch pipe, one for 18 and 24-inch pipe, and one for sewers over 2 feet in diameter. The machines will be sold outright or will be rented at a fixed price per month.

After the first rope is passed through the sewer and the braces are set, it is not necessary for a man to enter the sewer until the cleaning is done. Three men can operate the whole apparatus.

Engineers and contractors who have used the machine say that it is effective and that the cost of cleaning is low as compared with other methods used by them. The apparatus is now sold by the Hayden Machinery and Supply Co., 30 Church st., New York City, who will send any further information desired.

High-Grade Engineering Instruments.

The Hanna Manufacturing Co., Troy, N. Y., issue a well-designed and executed catalog, which is an indication of the quality of the instruments they make. They have a full line of engineers' transits of several designs, including light mountain, explorers' and reconnoissance transits, also engineers' and architects' levels, solar attachments, current meters, sextants, leveling rods, barometers, tapes, rods, poles, etc. They have the Verschoyle pocket transit also.

Clark Brown's chart method of reducing polaris observations is set forth in full in the catalog, which contains much other useful information about various instruments, their construction, care, adjustment and use. Copy of the catalog will be sent on request.

Specifications for Reinforcement Bars.

The Association of American Steel Manufacturers has adopted standard specifications for concrete reinforcement bars, copies of which can be obtained by addressing the secretary, Jesse J. Shuman, care Jones & Laughlin Steel Co., Pittsburg, Pa.

The specifications cover the process of manufacture, the chemical and physical properties, method and number of tests, number of twists, finish and variation of weight. The physical properties are fixed within limits for structural steel grade, hard grade and cold twisted bars.

The Passing of Old-Style Macadam.

Macadam's science has had its day. The principles of this famous Scotch engineer have been faithfully followed for some sixty years, but the coming of the automobile has brought the period to a close. Macadam's roads have been thoroughly satisfactory for Macadam's traffic, but he did not build surfaces that were calculated to stand the powerful shearing action of automobile wheels. The big pneumatic tires, carrying each a half ton's weight, press themselves closely against the brittle macadam surface, and then, with the power of forty horses, the heavy car is driven forward by the backward thrust of the tire against that surface. The result is inevitably the speedy loosening of the surface. No surface less hard than tar macadam would

fall to crumble under such a strain, so the result is a cloud of dust, and the fine crushed stone which the engineer has carried for miles to place upon the road surface is scattered recklessly over adjoining lawns and trees, not to mention the faces and clothing of pedestrians and residents.

A completely new science of road building has therefore begun during the past five years, and is now well advanced.

The modern engineer builds his roads with tarvia, a coal tar product, which gives to his surface an element of plasticity. The tarvia is a dense, pitchy substance of considerable adhesive power. When it is poured over the macadam and allowed to soak in it fills the voids and hardens into a tough, elastic matrix, from which the stone particles do not come loose. The thrust of automobile wheels on this surface does not make it crumble or pulverize.

The tarvia applications vary according to the conditions of the road and the thoroughness with which the surface needs to be protected against automobile wear. Many roads are now being built using tarvia from the foundation up to the top. A very dense kind of tarvia, known as Tarvia X, is used. It is poured over the stones until every stone is thoroughly coated with it and the voids are well filled. Then the smaller crushed stone of the upper course is spread and rolled into the tarvlated bed. The finished surface is a mosaic, a kind of tarvia-concrete, smooth and water-proof.

Tarvia can also be applied to roads that are built in the old way, although the application, being confined to the surface, is naturally less thorough. The kind of tarvia known technically as Tarvia A is painted over the road after it has been carefully swept to clean away surface dust and debris. The tarvia soaks into the macadam while it is hot, and then cools, making a tough, firm matrix for the stone.

DELTA AVENUE, ESCANABA, MICH. TREATED WITH TARVIA A.

A cheaper process is the Tarvia B process. Tarvia B has less solid base than the other kinds, and is liquid while cold, so that it can be used in an ordinary sprinkling cart without heating. It can only be used on roads that are thoroughly compacted and with smooth surface. It gives a good, dustless road which will withstand automobile traffic.

Of the three types of application, the Tarvia X process, which involves the use

of this material from top to bottom of the road, is the most thorough and most satisfactory in the end. A road so built will retain its evenness of contour almost indefinitely. Water and frost have practically no effect upon it, and the only deterioration which it suffers is from the actual friction of traffic.

Some engineers have reached the point where they are so well satisfied with tarvia processes from the standpoint of economy that they consider it unwise to build roads in any other way.

It is the settled policy of some towns to build all new roads in this way. As the new road building science develops, refinements in the process of application are being adopted. Elaborate machinery for spreading the tarvia is coming into use. Already it is cheaper to maintain a dustless road with tarvia than a dusty one without it.

Hand and Power Pumps and Appliances.

The Deming Company, Salem, O., show in their catalog for 1910 a very complete line of hand and small power pumps, containing over two dozen pumps of various designs and weights, from the little hand pump, weighing 9 pounds, for use in a bucket, to an outfit consisting of a pump run by a 3½-horse power gasoline engine, to pump from a tank on the same truck, and an auxiliary pump to fill the tank, the whole weighing about 2,725 pounds.

These outfits were developed originally for use in spraying vegetation, and can supply a pressure up to, say, 125 pounds. Pumps, tanks, trucks, etc., vary in design according to the demands, and one wishing a small pump can probably find one to suit him within the limits of size mentioned. Catalog will be sent by the company on request.

A Sanitary Street-Cleaning Machine.

Any city having reasonably heavy traffic over its streets requires for some of them a certain amount of hand cleaning, and the Menzies machine, which is operated by hand, has been devised to fill the demand. It consists of a two-wheeled cart, strongly built of iron and steel throughout, with castings of malleable iron, and a galvanized iron dust pan, with a spring steel blade 28 inches long and 6 inches wide, hung on the axle of the cart.

In operation the machine is pushed to the part of the pavement to be cleaned, the dust pan is lowered to rest on the pavement a little beyond the dirt to be gathered up, and an ordinary street broom is used to sweep the dirt over the blade into the dust pan. When the dust pan is filled, the operator steps to one side, grasps the handle with one hand, gives the machine a slight forward motion, raises the handle and the pan and dumps the dirt into the can set on the platform of the cart. The pan is then lowered and is again ready for use.

The platform on which the can sets is very near the ground, so that when the can is full it can be set off at the curb or elsewhere with ease and an empty can put in its place on the cart.

Shovel and scraper are not needed and the workman can clean about 50 per cent. more street than with the ordinary broom and pan, shoveling the dirt into an attendant cart.

The machine is very valuable also for use in parks, cemeteries, depots, hotels and public gathering places in and out of doors. Cart, can and broom complete the outfit. Full information about it can be obtained from the Menzies Street Cleaner Co., Glens Falls, N. Y. They also sell street sprinkling and street flushing machines.

Division Plates and Clamps for Sidewalk Work, Curb and Gutter.

The Smith patent rail clamps for concrete sidewalk, curbing and combination curb and gutter work are new devices which are very convenient and save much material and labor in setting and removing forms. S. C. Smith & Son, of Waverly, N. Y., are the manufacturers, and they claim the following points of advantage, which the writer thinks are well founded:

1. They are not expensive and are guaranteed to give satisfaction.
2. The same clamps can be used on all widths of walk, all widths of curbing, and all widths and shapes of combined curb and gutter.
3. There are no wedges to make and drive in and drive out, and pick up and take care of.
4. One man can withdraw the plates and finish.
5. Save 80 per cent. of time making and driving stakes.
6. Save 100 per cent. of the time required going back and patching broken corners caused by pounding the stakes loose in taking up the rails.
7. Save 100 per cent. of the time of going back after the rails the following day, as the rails are all loose and can be taken the same day the work is finished.
8. In laying walks over a fill you do not have to make and drive stakes 3 or 4 feet long; the clamps do the trick.
9. If you have steel division plates ⅛, 3-16 or ¼-inch thick, our clamps will fit them, and all you have to do is to drill a ¼-inch hole in each end of your plates.

A Deep-Well Pump.

The Downie double-stroke deep-well pumps are designed for elevating large quantities of water from great depths. They are better and more strongly made than usual, and so they cost a little more, but the makers claim they are much cheaper to run.

One special aim has been to eliminate the liability to derangement which is peculiar to deep-well pumps.

Much power is required to lift a heavy column of water, but the geared pump works with an efficiency of 80 per cent., the efficiency of the steam pump being 60 per cent.

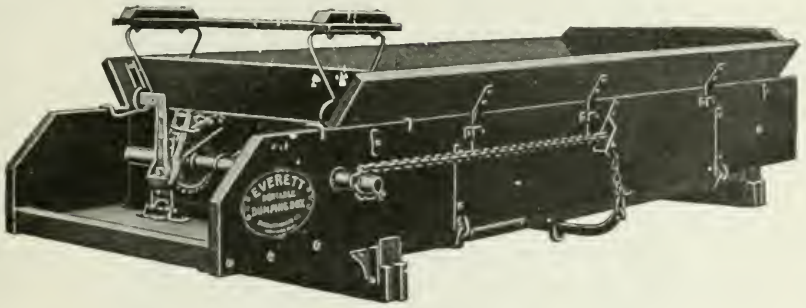
Catalog No. 6 of the Keystone Driller and Pump Co., Beaver Falls, Pa., can be had for the asking, and deals with pumps of the nature mentioned. The company also make Keystone cable drills for drilling deep wells.

An Efficient Portable Dumping Wagon Box.

The Everett portable dumping box is intended for any wagon having a reach and is made of widths required to fit wagons in general use and of any desired width on special order. It is strongly made, and braced with steel. The bottom is of four boards, two hung by "hook and eye" bearings from the sideboards of the box, and two hung from a steel tube running from end to end at the bottom of the box in the center. Thus the bottom can be quickly opened and the contents dumped on each side of the reach, without danger of damaging it. The bottom boards of the emptied wagon are lifted back to place by a steel truss running across the bed at the center, on which run rollers attached to castings bolted to the bottoms of the boards. This truss is lifted, for the purpose of closing the box, by means of chains at the two ends, which run up to rollers attached to the side of the box and thence to a steel tube running through the front end of the wagon in front of the front end board of the box. This tube is turned by a foot lever and winds up the chain by a three-quarters turn, enough to close the bottom boards tightly. Any slack in the chain is taken up by means of grab-links at the end of the chain, and the bottom can be set to open partly so as to give an opportunity to spread the load by driving along as the load runs out, by use of the same grab-links.

The foot lever locks automatically when the bottom is closed, so that the load cannot be dumped accidentally.

This dumping box has been in use by many contractors and engineers for a good many years and they say very enthusiastically that it has given satisfaction. They are in use on the Panama canal and the New York barge canal in large numbers, and by contractors in many cities and states throughout the country. The Everett Manufacturing Co., 84 Lake street, Newark, N. J., will send any further information desired.



THE EVERETT DUMPING BOX

Trade Publications.

Circulars descriptive of the Eclipse concrete mixers, post, tile, brick and block machines have been received from Geo. C. Christopher & Son, Wichita, Kan.

Several circulars about the inventors' pocket library have been received from the Engineer Searching Co., of Washington.

One of the most recent publications of the National Association of Paving Brick Manufacturers, Indianapolis, Ind., is a handsomely illustrated booklet on "The Permanent Roadway," illustrating the construction of brick country roads.

A recent number of *The Concrete Review* of the Association of American Portland Cement Manufacturers contains a brief summary of the proceedings of the last meeting of the Association of German Portland Cement Manufacturers.

Booklet No. 38 of the Jeffrey Mfg. Co. is about Jeffrey conveying machinery.

The Barrett Mfg. Co. issues a booklet on good roads, how to build, preserve and make them dustless, which describes and illustrates the use and the results of the use of Tarvia "A," "B" and "X." It is a handsome book well worth the trouble of asking for it at the nearest office of the Barrett Mfg. Co.

The American Book Co., New York, sends an illustrated description of Halley's comet by Prof. David Todd, which also contains some sample pages of Todd's "Astronomy."

The accompanying illustration is a part of the cover-plate of a lucid little treatise

on Portland cement, just issued by The Portland Cement Co., Union Trust building, Cincinnati, Ohio, for free distribution among those interested in knowing how this cement is made, of what it is made, and why it will last for ages.

One of the best of the publications of the Indianapolis office of the Lehigh Portland Cement Company contains "Forty-One Reasons Why Concrete Should Be Selected to the Exclusion of Any Other Type of Construction," by DeWitt V. Moore, C. E., of the Moore-Mansfield Co., Indianapolis.

Bulletin No. 72, of the Universal Portland Cement Co., talks about concrete bungalows, concrete wall without forms, and some notable concrete buildings.

The San Antonio Sewer Pipe Co., San Antonio, Tex., sends a catalog of vitrified sewer pipe, well tubing, culvert and irrigation pipe, including a price list.

The Case steam road roller is well shown and is described in full detail of all its parts in the latest catalog of the road machinery department of the J. I. Case Threshing Machine Co., of Racine, Wis. The catalog also shows the Troy dump wagons, the Case sprinkling attachment on their tank engine tender, and a couple of Case traction engines.

INTRODUCES THE STORY OF SUPERIOR PORTLAND CEMENT.

Trade Notes.

ASPHALT.

St. Paul, Minn.—The purchase of a municipal asphalt paving plant is recommended by the mayor.

St. Joseph, Mo.—The Metropolitan Paving Co. has been incorporated by R. N. Davis, C. F. Enright and J. O. Fanleigh, and will engage in a general street paving business.

BRICK.

Mechanicsville, N. Y.—The Ferris Paving Brick Co. has changed its name to the Mechanicsville S. S. Brick Co.

Devil's Lake, N. D.—The plant of the Devil's Lake Petrified Brick and Stone Co. has been leased by Hans Westegaard, who will put it in condition to manufacture brick.

CEMENT.

Cedar Falls, Ia.—The C. A. Wise Sons Co. and Rolla Cheney, composing the Cedar Falls Cement Co., have dissolved

partnership, Mr. Cheney withdrawing from the firm.

CONCRETE BLOCKS.

Waterloo, Ia.—The Cement Products Co. has been organized, with H. S. Raymond as president; Howard A. Sharp, vice president; Ernest E. Schenk, secretary; W. H. Stewart, treasurer.

Onawa, Ia.—A. B. Elliott, proprietor of the Turin Cement Block and Tile Plant, has purchased the K. A. Pullen Cement Block Plant.

Mason City, Ia.—The Quimby Stone Co. has added a cement block plant to its business.

Grace Hill, Ia.—Bertle & Son have built a cement plant at Westchester, Ia., and are making cement blocks.

Three Forks, Mont.—The establishment of a second cement plant is proposed by D. A. Morrison.

Lone Tree, Ia.—J. R. Corbett contemplates establishing a cement block and tile plant.

Deadwood, S. D.—Hanson Bros. have established a cement block plant here.

Kensett, Ia.—The business men have under consideration the establishment of a cement core factory.

Knightstown, Ind.—The Knightstown Concrete Co. has been incorporated to manufacture concrete building blocks, by Harry Watts, W. L. Garritson and E. B. Byrket.

PURCHASE OF MACHINERY.

Indianapolis, Ind.—For Sale.—A complete contractor's up-to-date equipment; everything complete for street paving; also for grading and macadamizing county roads. Will sell as a whole or part. Address Box 408, care Municipal Engineering Co., Indianapolis.

Chicago, Ill.—Special.—The Humboldt Mfg. Co., mnfrs. of material testing apparatus, 2014 Nebraska ave., is in the market for Nos. 100 and 200 mesh standard wire gauze for testing cement according to the specifications of the American Society of Civil Engineers.

PURCHASE OF MATERIALS.

Wilmington, N. C.—Riprap Stone.—Bids are asked until June 14 for about 12,000 tons of riprap stone. Capt. Earl I. Brown, corps engrs.

Plymouth, Mass.—Riprap.—Bids are asked until June 6 for riprap stone in dike in Long Beach, Plymouth Harbor, Mass.

Cleveland, O.—Testing Materials.—Bids are asked until June 8 for testing materials for 1 year. Frank R. Lander, co. engr.

LIGHT, HEAT AND POWER.

Holdredge, Neb.—P. H. Cobb, of Funk, has obtained a patent on an acetylene gas lighting machine.

MISCELLANEOUS.

Lexington, Ky.—The Empire Bridge Co. has been incorporated by George Collins, Georgia E. Collins, Adelaine M. Hallett, James M. Young and E. F. Metcalfe, of Lexington.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Pine Bluff, Ark.—Paving is urged for 5th ave.

Kenneth, Minn.—Cement sidewalks are contemplated.

Moose Lake, Minn.—Cement sidewalks are contemplated.

Moorhead, Minn.—This city voted to pave 1st ave. N.

Council Bluffs, Ia.—Paving is contemplated for 5th st.

Elmira, N. C.—Paving is contemplated for E. Union st.

Altoona, Pa.—Resurfacing is proposed for the paved streets.

Ft. Scott, Kans.—Paving is again being urged for S. Main st.

The Dalles, Ore.—The city council voted to pave with bitulithic.

Monroe, Ia.—Council has decided to pave B ave., W., and N. D st.

Normal, Ill.—Paving is contemplated for Ash st. and Virginia ave.

Manchester, Ia.—Cement paving is contemplated for Franklin st.

Hanly Falls, Minn.—A cement walk in 5th ave., W., is contemplated.

Manchester, Ia.—About 8 blocks of concrete paving are contemplated.

St. Charles, Minn.—Sidewalks in Winona and Church sts. are contemplated.

Rochester, Minn.—Council has been asked to pave Broadway and Main sts.

Ft. Dodge, Ia.—The construction of sidewalks in 18th st. is proposed.

Oskaloosa, Ia.—Council will take action June 6 on paving several streets.

Baraboo, Wis.—Macadam paving in Walnut and Maple sts. is contemplated.

Cooperstown, N. D.—The construction of concrete sidewalks is contemplated.

Kearney, N. J.—Davis st. will probably be paved with tarvia-coated telford.

Cherokee, Ia.—Paving is contemplated for the principal streets. Mayor Titus.

Utica, N. C.—Resolutions are pending for paving McQuode st. and Downer ave.

Highland Park, Mich.—This village voted to issue $89,000 for repaving Woodward ave.

Lestershire, N. Y.—The village bd. of trustees has decided to macadamize Main street.

Crystal Falls, Mich.—The estimated cost of paving Crystal ave. is $30,000 to $40,000.

Gadsden, Ala.—The construction of

sidewalks in various streets is contemplated.

Bedford, Ia.—Paving has been petitioned for in Washington and other streets.

Manchester, Ia.—Council will take action June 7 on paving and curbing Franklin st.

Marion, Ia.—Council will take action June 6 on paving small alleys with brick blocks.

Kalispell, Mont.—The city engineer will prepare plans for bituminous asphalt paving.

Albany, N. Y.—Paving is contemplated for Learned st., from N. Ferry to Thatcher st.

Davenport, Ia.—Plans have been prepared for paving Mound and other streets with brick.

Wellington, Kans.—Paving is contemplated for Lincoln ave., from Washington to Peek st.

Denison, Tex.—Gandy st., one of the leading residence streets, will probably be paved.

Houston, Tex.—Extensive paving is proposed for the roads in the vicinity of the Country Club.

Reading, Pa.—City Engineer Ulrich recommends repairs for the asphalt and brick streets.

Carmi, Ill.—Will vote June 4 on the issue of $8,000 bonds for constructing concrete sidewalks.

Roseburg, Ore.—Jackson and Main sts. will be paved with asphalt. A. N. Orcutt, cy. recdr.

New Cumberland, Pa.—The borough council has appropriated $20,000 for macadamizing streets.

Bloomfield, Ia.—A petition has been submitted to council asking that the public square be paved.

Springfield, O.—The property owners in Yellow Springs st. will petition for asphalt block paving.

Coeur d'Alene, Idaho.—This city will expend $20,000 on paving and other street improvements this year.

Pueblo, Colo.—The question of paving additional streets in the business district is being urged.

Lonsdale, Minn.—The village council contemplates the construction of cement sidewalks in Main st.

St. Cloud, Minn.—It is now proposed to pave 5th ave. with creosoted wood blocks instead of macadam.

Charleston, Ill.—The construction of 1¼ mi. of pavement is contemplated. J. A. Tremble, cy. engr.

Savannah, Ga.—Ordinances are being prepared for paving Whitaker, Abercorn and Barnard sts. and Estill ave.

Williamsville, N. Y.—Paving is contemplated for Main st. Milton J. Hoffman, prest. bd. vil. trustees.

Clear Lake, Ia.—S. J. Clausen is chairman of a committee appointed to build an automobile road 20 mis. long.

St. Louis, Mo.—Paving is contemplated for Biddle, 13th, 7th, 8th, 10th and 11th sts., in the Ghetto dist.

Binghamton, N. Y.—The bd. of contract and supply decided, May 12, to pave Main and Front sts. with brick.

Chicago, Ill.—Creosoted wood block paving is contemplated for Clark, La Salle, Randolph and Washington sts.

Rochester, N. Y.—An ordinance has been passed providing for brick paving in Magnolia st. Mayor Edgerton.

Bellingham, Wash.—H. W. Troutman, cy. engr., will investigate bitu-mass paving in a number of eastern cities.

Springfield, Mo.—Plans are being formulated for paving Elm, Cherry, Walnut, St. Louis, Fremont, Kickapoo, Pickwick, Minor, Weller and other streets with Hassam and brick.

Dallas, Tex.—The property owners in Haskell ave., between Ross and McKinley, have petitioned for permanent paving.

Olympia, Wash.—Council has authorized the paving of Franklin st. and grading of Jefferson, Chestnut and other sts.

Taylor, Tex.—The city council has voted to accept the offer of the business men to pave Main st. with vitrified brick.

Minneapolis, Minn.—A resolution has been passed to construct curb and gutter in a number of streets. Henry N. Knott, cy. clk.

Rockford, Ill.—A petition is being circulated for paving Baker st., in Highland, from E. State st. to 2nd ave., with asphalt.

Marshalltown, Ia.—The property owners in the proposed brick paving district have now petitioned for concrete rather than brick.

Albany, N. Y.—An ordinance has been passed for paving Cherry st. from Franklin to Broadway. Frederick U. Bresler, clk. com. coun.

Indianapolis, Ind.—A resolution has been adopted to pave E. Washington st. from Audubon road to Sheridan ave. with wooden blocks.

Two Harbors, Minn.—Council voted to grade, macadamize and construct concrete and combination curb and gutters in Poplar and Cedar sts.

New Albany, Ind.—A preliminary resolution was adopted May 6 for paving W. Market st. with brick, asphalt, bitulithic or wooden blocks.

Pekin, Ill.—An ordinance has been passed to pave 3rd st. Place with brick on concrete. Estimates are being prepared for paving 2nd st.

Crookston, Minn.—The property owners are divided on the question of paving with asphalt or creosoted wood blocks. J. E. Carroll, cy. engr.

Pine Bluff, Ark.—The property owners in W. 5th ave. have decided upon asphalt or creosoted wood block paving over the present macadam pavement.

Indianapolis, Ind.—The property owners in certain streets have asked that bitumass be included in the paving specifications in this city.

Minneapolis, Minn.—Plans are being formulated for constructing a boulevard 150 ft. wide connecting this city and St. Paul with Lake Minnetonka.

Little Rock, Ark.—The petition and ordinance to pave Main st. with brick, asphalt or creosoted wood blocks have been adopted. Mayor Duley.

Dallas, Tex.—The question of paving San Jacinto st., from Akard st. to Washington ave., with bitulithic or sawed bois d'arc blocks is being considered.

Ft. Worth, Tex.—Paving is contemplated for all the unpaved crosss-town streets between Throckmorton and Commerce sts. Comr. Maddox, of sts. and public grounds.

Corning, Ia.—Special.—A resolution of necessity has been published for constructing 35,000 sq. yds. of brick paving. Theo. S. DeLay, cons. engr., Creston, Ia.

St. Cloud, Minn.—A petition is being circulated among the property owners in 5th ave., asking the city council to change the paving specifications from macadam to creosoted wood blocks.

Virginia, Minn.—Paving is contemplated as follows: Chestnut st. and part of Central ave., creosoted wood blocks; Maple st. and Central ave., creosoted wood blocks, bitulithic, granitoid, tar macadam and donellite.

Peoria, Ill.—Ordinances are pending for paving Meyers and California aves. with brick; resurfacing Perry ave. with asphalt; paving Walnut st. with brick. Estimates have been submitted of the cost of paving Adams st. with creosoted wood blocks.

CONTRACTS TO BE LET.

Medora, N. D.—Bids are asked until June 6 for road work. J. A. McGregor, co. audt.

Fowler, Ind.—Bids are asked until June 6 for constructing a road. Lemuel Shipman, co. audt.

Delphi, Ind.—Bids are asked until June 6 for constructing a gravel road. M. G. Haun, co. audt.

Greensburg, Ind.—Bids are asked until June 7 for constructing macadamized roads. Co. comrs.

Marion, Ind.—Bids are asked until June 7 for constructing a stone road. A. V. Stout, co. audt.

Brazil, Ind.—Bids are asked until June 6 for constructing a gravel road. Jas. L. Burns, co. audt.

Tipton, Ind.—Bids are asked until June 6 for constructing 6 gravel roads. J. F. Barlow, co. audt.

Madison, Ind.—Bids are asked until June 7 for constructing a gravel road. John Hoagland, supt.

Winamac, Ind.—Bids are asked until June 7 for constructing a road. Ellis S. Rees, co. audt.

Trenton, N. J.—Bids are asked until June 7 for macadamizing roads. Frank J. Epple, co. engr.

Richmond, Va.—Bids are asked until June 7 for constructing 4½ mis. gravel road. Co. clk.

Perth Amboy, N. J.—Bids are asked until June 6 for grading Groom st. Geo. M. Adam, st. comr.

Augusta, Ky.—Bids are asked until June 1 for constructing 7,800 ft. of pike. J. T. McCracken.

Peru, Ind.—Bids are asked until June 8 for constructing 5 gravel roads. Chas. Griswold, co. audt.

Vernon, Ind.—Bids are asked until June 6 for constructing pike roads. T. L. Thomas, co. audt.

Vincennes, Ind.—Bids are asked until June 7 for constructing a gravel road. J. T. Scott, co. audt.

Crawfordsville, Ind.—Bids are asked until June 7 for improving a highway. Bennett B. Engle, co. audt.

Janesville, Wis.—Bids are asked until June 15 for paving Wisconsin and E sts. C. V. Kerch, cy. engr.

Greencastle, Ind.—Bids are asked until June 6 for constructing a macadam road. D. V. Moffett, co. audt.

Williamsport, Ind.—Bids are asked until June 6 for constructing gravel roads. Robt. L. Winks, co. audt.

Kentland, Ind.—Bids are asked until June 6 for constructing a macadam road. Elmer R. Bingham, co. audt.

Wabash, Ind.—Bids are asked until June 7 for constructing 6 gravel roads. J. P. Noftzger, co. audt.

Lafayette, Ind.—Bids are asked until June 11 for constructing a gravel road. John P. Forsman, co. audt.

Mt. Vernon, Ind.—Bids are asked until June 7 for constructing a gravel road. Paul Maier, co. audt.

Tipton, Ind.—Bids are asked until June 6 for constructing 6 gravel roads. J. F. Barlow, co. audt.

Virginia, Minn.—Bids are asked until about June 15 for paving various streets. E. F. Johnson, cy. engr.

Bloomfield, Ind.—Bids are asked until June 7 for constructing gravel roads. Peter M. Cook, co. audt.

English, Ind.—Bids are asked until June 6 for constructing improved roads. J. Evans Jones, co. audt.

Decatur, Ind.—Bids are asked until June 6 for constructing 4 macadam roads. H. S. Michaud, co. audt.

Washington, Ind.—Bids are asked until June 7 for constructing a gravel road. Thos. Nugent, co. audt.

Monticello, Ind.—Bids are asked until June 7 for constructing a stone road. A. G. Fisher, co. audt.

Bluffton, Ind.—Bids are asked until June 9 for constructing 4 gravel roads. O. D. Garrett, co. audt.

Muncie, Ind.—Bids are asked until June 8 for constructing a highway in Center twp. Jos. E. Davis, co. audt.

Wauseon, O.—Bids are asked until June 6 for grading, draining and placing stone on roads Nos. 70 and 71. Co. audt.

Cooperstown, N. D.—Bids are asked until June 6 for road grading in Bryan and Addie twps. R. M. Cowen, co. audt.

La Moure, N. D.—Bids are asked until June 6 for constructing sidewalks and street crossings. B. W. Loppinow, cy. audt.

Mt. Gilead, O.—Bids are asked until June 3 for constructing Westfield road impvt. No. 2. Clifton Sipe, co. audt.

Southport, Ind.—Bids are asked until June 6 for constructing cement sidewalks in Church st. A. L. Barnes, town clk.

Brazil, Ind.—Bids are asked until June 7 for constructing cement sidewalks in National ave. Jacob Prevett, cy. clk.

St. Paul, Minn.—Bids are asked until June 6 for improving White Bear and Lake Phalen roads. E. G. Krahmer, co. audt.

Hutchinson, Kans.—Bids are asked until June 3 for improving 3 roads, 8, 4 and 3 mis., respectively. A. R. Hamma, co. clk.

Upper Alton, Ill.—Bids will be asked about June 12 for paving Main and Garden sts. with vitrified brick. S. Crawford, mayor.

Rushville, Ind.—Bids are asked until June 7 for constructing brick streets in this city and suburbs. J. M. Stone, co. audt.

Valparaiso, Ind.—Bids are asked until June 7 for constructing a macadamized road in Porter and Liberty twps. S. P. Corboy, co. audt.

Cincinnati, O.—Bids are asked until June 3 for resurfacing Montgomery pike and oiling Harrison pike. Fred Dreihs, clk. co. comrs.

Kenmare, N. D.—Bids are asked until June 14 for constructing 2,700 ft. of roads and 2 culverts. Christ. Anderson, clk. town of Rockford.

Mishawaka, Ind.—Bids are asked until June 6 for 3,100 sq. yds. of brick paving between tracks in W. 2nd st. Jas. W. Haverly, cy. engr.

Eveleth, Minn.—Bids will be asked about July 1 for constructing cement sidewalks and curbing. D. B. Austin, cy. engr.; D. P. McIntyre, cy. clk.

Jackson, Miss.—Bids are asked until June 7 for constructing 39,000 sq. yds. of paving and 10,000 lin. ft. of curbing. B. H. Klyce, cy. engr.

Logansport, Ind.—Bids are asked until June 9 for constructing a gravel road in Cass and Carroll counties. Geo. W. Cann and M. S. Haron, co. audts.

Fort Sam Houston, Tex.—Bids are asked until June 9 for macadamizing roads, constructing concrete gutters, concrete walks, etc. P. W. Guiney, constr. Q. M.

Abilene, Kans.—Bids are asked until June 9 for 30,000 sq. yds. of paving, concrete curb and gutter, storm sewers and outlets. J. A. Graves, cy. clk.

Lebanon, Ind.—Bids are asked until June 6 for constructing a gravel road in Eagle twp. and brick paving through Zionsville. B. F. Herdrich, co. audt.

Princeton, W. Va.—Bids are asked until June 8 for constructing 3 mis. of macadam, tar or asphalt macadam, or bitulithic paving. F. R. Antwerp, ch. engr.

Indianapolis, Ind.—Bids are asked until June 3 for resurfacing and paving roadways and sidewalks in a number of streets. C. A. Schrader, prest. B. P. W.

Springfield, Ill.—Bids will be asked about June 6 for 20,822 sq. yds. of vitrified brick paving in 13th st., with sandstone curbing. Frank Hamilton, cy. engr.

Wabash, Ind.—Bids are asked until June 9 for constructing a highway on dividing line of Wabash and Huntington counties. John W. Weaver, audt. Huntington co.

Portland, Me.—Bids are asked until June 6 for improving the roadway at Eastern Parade. Jas. P. Jordan, chm. comrs. Cemeteries and Public Grounds, 410 Fore st.

Albany, N. Y.—Bids are asked until June 6 for the repair and resurfacing of a large number of highways. S. Percy Hooker, chm. State Highway Com., 53 Lancaster st.

Racine, Wis.—Bids are asked until June 4 for 3,000 sq. yds. of brick paving in Douglas ave. and 2 blocks of asphalt in Carlisle ave. P. H. Connelly, cy. engr.

Lucas, O.—Bids are asked until June 6 for 27,266 sq. yds. of paving, 7,520 lin. ft. curbing, 1,592 ft. 8, 10 and 12-in. sewer pipe. Geo. V. Raab, clk. vil. coun.

Dunkirk, N. Y.—Bids are asked until June 2 for constructing 19,000 sq. yds. of asphalt resurfacing in W. 4th st. and paving Swan and Fox sts. R. H. Heppell, cy. clk.

Billings, Mont.—Bids are asked until June 7 for constructing 32,040 sq. yds. of vitrified brick paving and 22,644 sq. yds. of creosoted wood block paving. J. D. Matheson, cy. clk.

Columbus, Ind.—Bids are asked until June 6 for 7,000 sq. yds. of brick, asphalt, bitulithic or creosoted wood block paving. Edwin A. Conn, cy. clk.; Wm. H. Rights, cy. engr.

New Hartford, N. Y.—Bids are asked until 4 p. m., June 1, for constructing 6,800 lin. ft. of combined concrete curb and gutter in Genesee st. A. B. Baker, prest. vil. bd. trustees.

Shelbyville, Ind.—Bids are asked until June 7 for grading and graveling a number of streets and alleys and for constructing cement sidewalks and curbs in several streets. L. E. Webb, cy. clk.

Albert Lea, Minn.—Bids are asked until June 7 for 12,423.86 sq. yds. of creosoted wood blocks, vitrified brick, mineral rubber or sandstone paving and 4,388 cu. yds. excavation in Main st. Wm. Barneck, cy. engr.

Wadesboro, N. C.—Bids are asked until June 3 for constructing 18,000 sq. yds. of 8 in. macadam, 2,500 lin. ft. combined concrete curb and gutter, 6,000 sq. yds. of cement sidewalk and 4,000 cu. yds. excavation. W. K. Boggan, mayor.

CONTRACTS AWARDED.

Schenectady, N. Y.—The contract for paving Willett st. was awarded to the Union Paving Co.

Duluth, Minn.—Diffon & Richie, of this city, secured the contract for repaving Hughitt ave.

Buffalo, N. Y.—The Barber Asphalt Paving Co. was awarded a contract, May 13, for paving Jefferson st.

Peoria, Ill.—John McAllister was awarded the contract for paving Garden st. with brick, for $30,195.76.

Dayton, O.—The contract for furnishing 8 carloads of asphalt was awarded to the California Asphalt Co.

Bellingham, Wash.—K. Sauset was awarded the contract for paving Chestnut st. with asphalt, for $28,704.

Penn Yan, N. Y.—The contract for paving Elm st. with brick was awarded, May 18, to C. N. Kelly, for $13,640.

Evansville, Ind.—The Western Construction Co. was awarded the contract for paving Powell ave. with asphalt.

Clinton, Okla.—The contract for sheet asphalt paving was awarded to the Heman Construction Co., of St. Louis.

Tacoma, Wash.—The Independent Asphalt Paving Co. was awarded the contract for paving Steele st., for $25,643.

Wenatchee, Wash.—Allen & McNerney secured the contract for 3,000 ft. of paving in Mission st., for $25,643.

Lafayette, Ind.—Daniel H. Fatout, of Indianapolis, was awarded a contract for constructing a gravel road, for $5,573.

Houston, Tex.—E. G. Smith was awarded the contract, May 14, for road work on the Lynchburg and Crosby road, for $22,200.

Houma, La.—The contract for constructing 1½ mis. of Schillinger pavement in Main st. was awarded to Garber & Maltby.

Pekin, Ill.—D. H. Jansen & Co. secured the contract for paving Washington st., May 7, at $1.69 a sq. yd., or $26,975.

Marion, Ind.—The contract for constructing the Grant Cole gravel road was awarded to Alexander & Crosby, of Bluffton, for $8,539.

Peoria, Ill.—J. W. Bushell was awarded a contract for paving 7th ave. and Hamilton and Jefferson sts. with asphalt, for $52,000.

San Jose, Cal.—Road contracts have been let as follows: John F. Adams, 6,705 ft., $8,779; John W. Wilson, 10,100 ft., $9,500.

Mt. Carmel, Pa.—The contract for paving was awarded to the Cowell Construction Co., of Williamsport, Pa., for $32,464.

Mt. Pleasant, Ia.—The contract for paving was awarded to the Burlington Construction Co., of Burlington, Ia., at $2.095 a sq. yd.

New Haven, Conn.—The contract for granite concrete paving was awarded to Field, Barker & Underwood, of Philadelphia, for $10,920.

Wheeling, W. Va.—The contract for paving the east side of Chapline st. was awarded to R. B. McCullough, at 37 cts. a sq. yd.

Evansville, Ind.—The Western Construction Co. was awarded a contract, May 11, for paving Main st. with asphalt, at $1.96 a sq. yd.

Kansas City, Mo.—The contract for 1,800 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., 619 American Bank Bldg.

Amarillo, Tex.—The contract for the engineering and supervision of street paving and sewer extension was awarded to L. Dalton, of Dallas.

Centerville, Ia.—McGuire & Stanton, of Leavenworth, Kans., secured the contract, May 13, for 25,930 sq. yds. of brick paving, for $64,711.

Enola, Pa.—The contract for constructing granolithic sidewalks and paving was awarded to S. W. Shoemaker & Son, of Harrisburg, for $25,000.

Dallas, Tex.—(Special). The Texas Bitulithic Co., Praetorian Bldg., was awarded a contract for 5,780 sq. yds. of bitulithic paving.

Anderson, Ind.—Lawson & Klucade, of Indianapolis, secured the contract for paving Columbus ave., with No. 1 Indiana brick, for $23,000.

Mexico, Mo.—D. C. Owen was awarded the contract for paving E. Promenade st. with brick at $1.48 a sq. yd. and 38 cts. a lin. ft. for curbing.

Holdenville, Okla.—The contract for constructing 18 blocks of Oklahoma rock asphalt paving was awarded to the Shelley-Downard Co., of Ardmore.

St. Paul, Minn.—The contract for macadamizing Concord st. in South St. Paul, was awarded to Thorntown Bros., of this city, for $9,017.

Mishawaka, Ind.—The contract for paving Mill st. with bitulithic was awarded May 16 to the Western Construction Co., at $1.67 a sq. yd.

Highland Park, Ill.—The contract for repaving 27,000 ft. of Waverly ave. was awarded to the Schmidt Contracting Co., of Chicago, for $15,134.

Memphis, Tenn.—The Barber Asphalt Co. was awarded the contract, May 17, for paving Rayburn boulevard and McLemore ave. with asphalt, for $22,449.12 and $21,983.20, respectively.

Harlan, Ia.—The Lane Construction Co. was awarded the contract for paving, guttering and curbing the public square and 5th st. for $54,000.

Richmond, Cal.—The contract for paving 7th st. and Neoun ave. was awarded to Geo. A. Cushing, of Oakland, Cal., for $15,673 and $22,388, respectively.

Berkeley, Cal.—The Esterly Construction Co. was awarded the contract for 500,000 ft. of cement sidewalks to be laid in Northbrae, for about $50,000.

La Grande, Ore.—Special)—The Warren Construction Co., 317 Beck Bldg., Portland, secured the contract for 23,000 sq. yds. of bitulithic paving.

Mineola, L. I., N. Y.—The contract for macadamizing Conklin st., in Farmingdale, was awarded to Powers & Wheeler, of Oyster Bay, at 83 cts. a sq. yd.

Baker City, Ore.—(Special)—The contract for 30,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland.

Little Falls, N. Y.—(Special)—Warren Bros. Co., 59 Temple Place, Boston, was awarded a contract for 3,830 sq. yds. of bitulithic paving in this city.

St. Joseph, Mo.—C. W. Dillingham was awarded a contract May 14 for paving 4th st., from Faraon to Isabelle, with Cuban asphalt, for $17,595.

Denver, Col.—Anderson, Ord & Swope, of Colorado Springs, secured the contract for grading and curbing 6½ mis. of Montclair boulevards, for $154,209.90.

El Paso, Tex.—(Special)—The contract for 8,349 sq. yds. bitulithic paving was awarded to the Texas Bitulithic Co., Praetorian Bldg., Dallas, Tex.

Richmond, Va.—The contract for paving the streets surrounding the John Marshall High School was awarded to I. J. Smith & Co., at $2.20 a sq. yd.

The Dalles, Ore.—(Special)—The contract for 18,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland.

Cleveland, O.—The Enterprising Paving and Construction Co. was awarded a contract May 14 for paving Hebert Hill with Medina block stone, for $8,550.

Ft. Worth, Tex.—(Special)—The Texas Bitulithic Co., Praetorian Bldg., Dallas, secured the contract for 25,557 sq. yds. of bitulithic paving in this city.

St. Paul, Minn.—The contract for repaving Summit ave. with asphalt was awarded to the General Contracting Co., Temple Court, Minneapolis, for $53,940.

Enid, Okla.—The Warner-Quinlan Asphalt Co. was awarded the contract for paving Adams, Jefferson, Monroe, Cherokee, Washington and S. Grand sts., at $2.03 and $2.04 a sq. yd.

Galveston, Tex.—Kelso & Vautrin secured the contract for vitrified brick paving and combination cement curb and butter on all streets entering the seawall boulevard at right angles.

Norfolk, Va.—The Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, was awarded the contract May 4 for paving 20,300 sq. yds. of streets in Greater Ghent, for $38,367.

Havre, Mont.—The contract for constructing cement walks in special Impvt. districts Nos. 9, 10, 11, 12 and 13 was awarded to the Two Miracle Concrete Corporation of Minneapolis, for $8,500.

Louisville, Ky.—Contracts for vitrified block original street construction and aggregating $45,500, were awarded, May 9, to Henry Bickel Co. and the R. L. Figg Co., at $1.90 and $1.92 respectively.

Raleigh, N. C.—The Peters Bros. Paving Co. was awarded the contract for paving Fayetteville and Martin sts. and like streets around the Capitol Square at $1.70 a sq. yd.

Dallas, Tex.—The contract for paving Patterson ave. with brick was awarded to J. C. Underwood, at $2.56 a sq. yd. Coffeyville brick on concrete, with asphalt filler, will be used.

Ft. Dodge, Ia.—The Bryant-Ford-McLaughlin Asphalt Paving Co. was awarded a contract for 70,000 sq. yds. of asphalt paving and 35,000 lin. ft. of curb and gutter, at $1.98 a sq. yd. or $175,000.

Superior, Wis.—Bids for paving Belknap st. were submitted as follows: Creosoted wood blocks, Kettle River Co., $67,179.48; brick, Ed. Johnson, $67,005.31; bitulithic, Warren Bros., $68,361.63.

Port Jervis, N. Y.—Mulerry Bros., of Albany, N. Y., secured the contract, May 11, for constructing about 11,000 sq. yds. of vitrified brick paving, in Pike and Front sts. and New Jersey ave., for $23,800.

Akron, O.—Contracts were awarded May 14 as follows: Reconstructing Mill st. with Medina stone, Wildes & Davidson, $22,289; Glenwood ave., Daniel O'Marr; W. Buchtel ave., brick and tar filler, McAllonan Bros., $5,664; Washington st., E. W. Shaffrey & Sons.

Chicago, Ill.—The American Asphalt Paving Co. was awarded contracts for resurfacing and paving portions of nine streets, April 29. The Ryan Paving Co. was awarded the contract for paving W. 43d st. with granite.

Portland, Ore.—(Special) — Contracts for bitulithic paving have been awarded as follows: 27,570 sq. yds., Warren Construction Co., 317 Beck Bldg., 5,912 sq. yds., Pacific Bridge Co., Mohawk Bldg.; 65,000 sq. yds., Pacific Bridge Co., Mohawk Bldg.; 40,000 sq. yds., Warren Construction Co., 317 Beck Bldg.

Newark, N. J.—The John F. Shanley Co., 36 Exchange Place, Jersey City, was awarded the contract for paving New and Hamilton sts. with bitulithic, for $11,231.

Grants Pass, Ore.—Special)—The Warren Construction Co., 317 Beck Bldg., Portland, secured the contract for 25,000 sq. yds. of bitulithic paving in this city.

Albert Lea, Minn.—The contract for constructing curbing in Main and Wash-

ington sts. was awarded May 17 to the Albert Lea Construction Co., for $4,620.

Duluth, Minn.—The contract for constructing macadam paving in Tower ave. was awarded to J. B. Palmer, for $6,212.50 and for Stinson ave. to E. Hawarden, for $950.

Niagara Falls, N. Y.—(Special)—The contract for 13,240 sq. yds. of bitulithic paving in 10th st. was awarded to Warren Bros. Co., 59 Temple Place, Boston, Mass.

St. Boniface, Man.—(Special)—The contract for 65,000 sq. yds. of bitulithic paving was awarded to the Bitulithic and Contracting Co., Ltd., Empers Block, Winnipeg, Man.

Elgin, Ill.—(Special)—Arwin E. Price was awarded the contract for 31,530 sq. yds. of bitulithic brick paving on 5 in. concrete base, for $59,279.47.

Cincinnati, O.—(Special)—Warren Bros. Co., 59 Temple Place, Boston, Mass., secured the contract for 42,150 sq. yds. of bitulithic paving in Clifton ave., this city.

Lewiston, Idaho.—(Special)—The contract for constructing 17,974 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland, Ore.

Wichita, Kans.—(Special)—The contract for 11,906 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., 619 American Bank Bldg., Kansas City.

Danville, Va.—(Special)—The Atlantic Bitulithic Co., 1126 Mutual Bldg., Richmond, Va., was awarded a contract for 28,566 sq. yds. of bitulithic paving in this city.

Roanoke, Va.—The contract for constructing a street under the railroad tracks at Lynchburg ave., Northwest Roanoke, was awarded to the Vaughn Construction Co., for $40,000.

Hartford, Conn.—Contracts for state road work were awarded May 17 to John De Michiel & Bros., of Torrington, Conn., Merritt & Bush, of Stamford, Conn., and F. Arigoni & Bro., of Durham.

Seattle, Wash.—Hans Pederson, Alaska Bldg., secured the contract for paving Western ave. et al. with granite paving and granite alley crossings, for $129,781.

New York City.—(Special)—The Standard Bitulithic Co., Hudson Terminal Bldg., secured the contract for 9,386 sq. yds. of bitulithic paving on Steubenville Pike, Allegheny Co., Pa.

St. Joseph, Mo.—The Metropolitan Paving Co. was awarded the contract May 21 for resurfacing Jule st. with brick at $1.48 a sq. yd. The Phoenix Brick and Construction Co. was awarded the contract for paving Anglique st. with brick, at $1.89 a sq. yd.

Rochester, N. Y.—Contracts for paving were awarded May 12 to Whitmore, Rauber & Vicinus, as follows: Tallniger alley, asphalt, $2,933.50; Mt. Hope st., asphalt and Medina block, $24,545; Oakland st., brick, $9,678.50; Federal st., brick, $18,567.

Leavenworth, Kans.—The contract for regrading and paving 6th, Chestnut, Vine, Charles, Pine and Middle sts. was awarded to O. C. Chapion, for $23,118.55; 4th and 2d sts., E. W. Gerger, $26,876.62; two alleys, Thos. Jones & Son, $1,917.58.

Mishawaka, Ind.—Bids for paving Mill st., were submitted as follows: W. H. Bell & Co., asphalt, $2.75 a sq. yd.; brick, $1.75; Western Construction Co., Trinidad Lake asphalt, $1.69, bitulithic, $1.67; Rankert & Eggleston, brick, $1.60; Stevenson Construction Co., of Chicago, asphalt $1.85, brick $1.65; Peters Bros. Paving Co., Obispo asphalt, $1.70.

Utica, N. Y.—New bids were submitted May 11 for paving 12 streets, the Barber Asphalt Paving Co. bidding $1.79, John R. Lee $1.85, and the Warner-Quinlan Asphalt Co., $1.86 a sq. yd. Bids were received April 20 on the same work, the respective companies bidding $1.91, $1.85 and $1.96 a sq. yd.

Louisville, Ky.—Contracts for constructing granitoid pavements were awarded, May 17, as follows: Brook, Jackson, Courtney and Greenwood sts., Marion County Construction Co., $29,000; Windsor Place, Willow ave., Bailey, Galt and Peterson sts., Barber Asphalt Paving Co., $40,000.

Louisville, Ky.—Contracts for granitoid paving were let May 16, as follows: Brook, Jackson, Courtney and Greenwood sts., Marion County Construction Co., $1.85 a sq. yd. or $29,000; Windsor Place, Willow ave., Bailey, Galt and Peterson sts., Barber Asphalt Paving Co., $1.97 a sq. yd., or $40,000.

Los Angeles, Cal.—The contract for asphalt paving in Wall st. was awarded to the Fairchild-Gilmore-Wilton Co. for $20,226. The Mesa Land Co. awarded a contract to J. A. Merrill for grading, oiling and constructing cement curb and sidewalks on 80 acres of the Angeles Mesa Tract, for $38,696; additional work to be done at the following rate, 23 cts. per lin. ft. for cement curbs, 8½ cts. per sq. ft. for cement walks, 11 cts. per sq. ft. for oiled streets and gutters, 18 cts. per cu. yd. for grading and moving dirt.

New York City.—Bids for paving have been submitted as follows: Richmond Boro, May 10, regulating and repaving on a concrete foundation with medina sand stone block pavement the roadway of Richmond ave., from Post ave. to Blackford ave., Thomas F. Carlin, Port Richmond, S. I., $19,670; Joseph Johnsons' Sons, Brooklyn, $21,643; W. J. Quinlen, Brooklyn, $19,835; Londine & Gallo, Brooklyn, $20,555; John E. Donovan, Brooklyn, $20,712.

Buffalo, N. Y.—Contracts have been awarded as follows: Repaving Pratt st. from Broadway to Genesee, to Henry P. Burgard & Co., $13,000; Woodlawn ave., from Main to Jefferson, Barber Asphalt Co., $19,000; Normal ave., from Vermont to Massachusetts, German Rock Asphalt and Cement Co., $7,087; Tenth st., from Virginia to Maryland, German Rock Asphalt and Cement Co., $3,940.

Buffalo, N. Y.—Bids were submitted, May 18, for paving Bryant st., as follows: Barber Asphalt Paving Co., asphalt, $7,290; Michigan st., German Rock Asphalt and Cement Co., asphalt, $15,830; Krettner st., German Rock Asphalt and Cement Co., asphalt, $10,870; Grey st., Genesee to High, Henry P. Burgard, asphalt, $4,950; alley off Cherry st., Barber Asphalt Paving Co., asphalt, $2,013.

St. Louis, Mo.—Contracts for paving 16 streets with asphalt, and reconstructing Washington ave. and Chestnut sts with wood blocks have been awarded as follows: Laurel, from Ridge ave. to Wells, the Parker Washington Co., $3,921.25 Holly, from Penrose to Carter, same, $7,351.30; Penrose, from Grand to Prairie, Skrainka Construction Co., $9,694.10; Taylor, from Ashland to Margaretta, same, $14,694.63; Gravois, from Arsenal to Grand, G. Evermann & Bro., $39,943.66; Coleman, from Montgomery to Garrison, same, $2,662.20; Walnut, from Tenth to Twelfth, Frederick Ruecking, $8,439.50; Adelaide, from Florissant to Rosalie, Granite Bituminous Paving Co., $8,205.56; King's Highway, from Gravois to Nottingham, G. A. Heman, $61,321.30; King's Highway, from Nottingham to Arsenal, same, $53,419; Washington, from Fourth

to Twelfth, the Parker Washington Co., $29,737.28; Fourth, from Chestnut to Washington, same, $14,549.52; Washington, from King's Highway to Union, same, $33,694.38; Ranschenbach, from Benton to Hebert, William H. Redemeyer, $17,172.30; Palm, from Broadway to Fourteenth, same, $13,308.48.

Brooklyn Boro, May 17.—Grading, curbing and constructing sidewalks in Haseman ave., Moran-Crowley Co., $31,123; Walter L. Cassell, 2627 Bedford ave., Brooklyn, $27,026; Leo E. Kelley, $34,242; S. Purificato, 449 East 116th st., New York, $25,592; Newman & Carey Co., $29,641. For regulating and paving with asphalt pavement on a concrete foundation the roadway of Seventh ave., from 43d st. to 49th st.: Uvalde Asphalt Paving Co., 1 Broadway, New York, $11,926; Cranford Co., $12,358; Barber Asphalt Paving Co., 30 Church st., New York, $12,580; Brooklyn Alcatraz Asphalt Co., 407 Hamilton ave., Brooklyn, $11,664. For regulating and paving with asphalt pavement on a concrete foundation the roadway of 72d st., between Second ave. and the Shore Road, with the exception of strip 12 ft. in width in the center of the roadway, from First ave. to a point about 338 ft. easterly, to be paved with granite block on a concrete foundation: Uvalde Asphalt Paving Co., 1 Broadway, New York, $12,569; Cranford Co., Brooklyn, $13,568; Barber Asphalt Paving Co., 30 Church st., New York, $14,129; Brooklyn Alcatraz Asphalt Co., 407 Hamilton ave., Brooklyn, $12,368. For regulating and paving with asphalt pavement on a concrete foundation the roadway of Sutter ave., from Van Sicten ave. to Berriman st.: Uvalde Asphalt Paving Co., 1 Broadway, New York, $16,577; Cranford Co., Brooklyn, $17,556; Barber Asphalt Paving Co., New York, $19,034; Borough Asphalt Co., $16,184.

SEWERS.

CONTEMPLATED WORK.

Bryan, Tex.—A sewerage system is contemplated.

Plano, Tex.—A sewerage system is contemplated.

Mondovi, Wis.—A sewer in Franklin st. is contemplated.

Tulare, Cal.—Plans for a sewerage system have been accepted.

Burch, Colo.—The town board has decided to construct a sewerage system.

Waupaca, Wis.—Bonds will be issued for constructing a septic tank and sewer.

Thief River Falls, Minn.—Council has decided to establish 3 new sewer systems.

Macon, Ga.—Bids will be asked soon for constructing the Vineville sewer system.

Huntington, W. Va.—This city voted to issue $125,000 bonds for constructing sewers.

Grandville, Idaho.—Will vote on issue of $50,000 bonds for sewer purposes June 6.

St. Charles, Ill.—Plans have been completed for a sanitary sewer system. F. B. Hunt, mayor.

Davenport, Wash.—The city council has authorized temporary plans for a sewerage system.

Carrollton, Mo.—The construction of lateral sewers is contemplated. J. F. Graham, mayor.

Hailey, Idaho.—The estimated cost of constructing a sewerage system is $40,839.09.

Oroville, Cal.—Plans will be prepared for constructing a sewerage system. E. J. Mitchell, cy. clk.

Quincy, Ill.—The special committee will report on the proposed North End sewer at the June meeting.

La Grande, Ore.—Louis C. Kelsey has been engaged as consulting engineer on the proposed sewerage system.

Iowa Falls, Ia.—Plans are being prepared for 7 blocks of vitrified tile sewer. F. Truman, cy. engr.

Topeka, Kans.—Plans are being prepared for constructing a new sewerage system in the western part of the city.

Madison, Wis.—Cy. engr. Ieke estimates the cost of constructing a new sewage disposal plant at $183,000.

San Antonio, Tex.—The council committee on sewers has recommended the construction of a number of sewers.

Irvington, N. J.—An ordinance has been passed to construct a sanitary sewer in 16th ave. W. L. Glorieux, mayor.

Charlottesville, Va.—This city contemplates constructing about 15,000 ft of sewer. E. T. Caruthers, cy. clk.

Bremen, Ind.—This city contemplates installing 8 blocks of vitrified clay tile sewer. T. S. Knoblock, cy. clk.

Gas City, Ind.—A committee has been appointed to investigate the advisability of constructing a trunk sewer line.

Franklin, Ind.—Plans are being prepared for the installation of a sewer 4 blocks in length. Thos. Moore, cy. clk.

Monroe, Wis.—Paul Hodges, cy. engr., is preparing plans for 14 blocks of gravity sewer. Christ Roth, cy. clk.

Warrensburg, Mo.—Plans are being prepared for a district sanitary sewer and septic tank. W. H. Sanders, cy. engr.

Jackson, O.—Plans have been completed for a reinforced concrete sewage disposal plant. Walter Rideneur, vil. clk.

Mason City, Ia.—Plans have been completed for 6 blocks of vitrified tile sewer in 6th and 10th sts. J. H. McEwen, cy. clk.

Sheboygan, Wis.—Plans have been completed for an intercepting sewer from Michigan ave. and N. 3d st. to the river.

Broken Bow, Neb.—Plans for a sewerage system will be prepared by the W. K. Palmer Co., Dwight Bldg., Kansas City, Mo.

Little Rock, Ark.—Plans have been formulated for constructing a sewer in the 8th ward. E. A. Kingsley, supt. pub. wks.

Los Gatos, Cal.—Plans and specifications have been adopted for constructing a sewer in San Jose ave. Bd. town trustees.

Waverly, Ia.—Council will consider a resolution, June 20, for constructing an 8 in. vitrified sewer in Fremont st.

Knoxville, Ia.—Council will take action June 15 on a resolution to construct a 10-in. vitrified pipe sewer in 4th st.

Elkhart, Ind.—A resolution has been adopted and a hearing will be held June 6 for constructing a sewer in E. Jackson st.

Spokane, Wash.—Plans have been approved for constructing a sewer system in the 4th and 5th wards. Cy. engr. Mccartney.

Dubuque, Ia.—Bids will be asked for soon for reconstructing concrete storm sewers in Cooler creek. C. H. Baumgartner, cy. engr.

Litchfield, Ill.—Plans have been prepared for constructing 8 blocks of vitrified tile sewer. A. Stropelin, secy. bd. local impvts.

Springfield, Mo.—A new district has been established in the northwestern section of the city, to be 3,000 ft. long. Plans

for a septic tank will be prepared by Harry G. Norton, cy. Engr., to be located at mouth of city sewer on the south side.

Guymon, Okla.—A petition is being circulated asking for an election to vote on the question of constructing a sewerage system.

Peru, Ind.—The construction of 1,200 ft. of 12 in. clay tile sewer in 9th st. is contemplated. Michael Horan, cy. engr.

Spencer, Ia.—Council will consider a resolution June 17 for the construction of an 8 in. salt-glazed vitrified pipe sewer in 6th st.

Albert Lea, Minn.—(Special)—Wm. Barneck, cy. engr., says plans are being prepared for an extension system of sewers, and bids will soon be asked.

Holland, Mich.—Plans are being prepared for crock tile sewers to be installed in 21st, 22d, 23d and 24th sts. H. A. Neberhaus, cy. engr.

Birmingham, Ala.—Maury Nicholson, cy engr., has completed plans and specifications for installing a storm drainage system for the Northlands.

Tullahoma, Tenn.—(Special)—Doak Aydelott, secy. Highlands Co. says summer and winter resort is being established and sewerage will be needed.

Cadillac, Mich.—Bids will be asked about June 1 for constructing a crock tile sewer. Plans are being prepared for 2 sewage disposal plants and bids will be asked about June 1. R. E. Elsner, cy. engr.

Yoakum, Tex.—Aldermen Shall and Maresh and J. M. Haller, J. Lyons, W. L. Johnston, W. T. Brain and Philip Welhausen have been appointed a committee to confer with the citizens as to the best plan for constructing a sewerage system.

Fitchburg, Mass.—The governor has signed the sewer bill which provides for the appointment of a sewer committee by the mayor, to have charge of constructing a sewage disposal system, drains and sewers.

New Orleans, La.—Major B. M. Harrod and Rudolph Hering, of the advisory board of engineers, who have been working with Engineers Earl, Kirkland, Raymond and Wood of the sewerage and water board, on plans for the economical completion of the water and drainage systems, have reported to the sewerage and water bd.

Visalia, Cal.—(Special)—Marve L. Weaver, cy. engr., advises us that municipal bonds for $95,500 were sold, May 18, and contracts for the work will be let as soon as possible thereafter. The greater part of the work will consist of the construction of about 860 lin. ft. of reinforced concrete conduit, and 2,040 lin. ft. of conduit of lighter construction.

CONTRACTS TO BE LET.

Vancouver, Wash.—Bids are asked until June 15 for constructing "B" st. lateral. Cy. clk.

St. Louis, Mo.—Bids are asked until June 21 for constructing River des Peres foul water sewer. B. P. I.

Forest City, Ia.—Bids are asked until June 7 for constructing tile work in drainage dist. No. 9. L. J. Nelson, co. audt.

Appleton, Wis.—Bids are asked until June 3 for constructing a concrete sewer in the 5th ward. C. H. Vinol, cy. engr.

Abilene, Kans.—Bids are asked until June 9 for constructing storm sewers, storm sewer outlets, etc. A. W. Rice, mayor.

Hot Springs, S. D.—Bids are asked until June 6 for constructing a lateral sewer in dist. No. 2. L. H. Herdrick, cy. audt.

Fort Missoula, Mont.—Bids are asked until June 6 for constructing a sewerage system. Major A. B. Shattuck, constr. Q. M.

Greenfield, Ind.—Bids are asked until June 7 for constructing a drain. G. W. Allen, drainage comr.

Regina, Sask.—Bids are asked until June 6 for constructing sewage disposal works. A. E. Chivers, cy. clk.

Princeton, W. Va.—Bids are asked until June 8 for constructing sanitary sewers. F. B. Antwerp, ch. engr.

Tallahassee, Fla.—Bids are asked until June 15 for excavating 5 drainage canals in the Everglades. J. O .Wright, ch. drainage engr.

Monticello, Ark.—Bids are asked until Aug. 3 for constructing about 7 mis. of 8 to 12 in. pipe sewers. Walter G. Kirkpatrick, engr., Jackson, Miss.

Ft. Sill, Okla.—Bids are asked until June 10 for constructing a sewage purification plant and reservoir. Capt. David L. Stone, constr. Q. M.

Council Bluffs, Ia.—Bids are asked until June 9 for constructing a drainage ditch along the course of Pigeon creek in Neola. R. V. Innes, co. audt.

St. Louis, Mo.—Bids are asked until June 7 for reconstructing concrete sewers in North Harlem districts Nos. 1 and 2. H. R. Fardwell, sewer comr.

Ft. Williams (Cape College, P. O.), Ore.—Bids are asked until June 4 for additions to the sewer system. Capt. C. F. Humphrey, Jr., constr. Q. M.

Havelock, Neb.—Bids are asked until June 7 for constructing a sewerage system with 41 manholes and reinforced concrete outlet. C. A. Currie, cy. clk.

York, Pa.—Bids are asked until June 6 for constructing sewers in Carlisle and Madison aves. and S. Queen and Manchester sts. Harry Washers, chm. B. P. W.

Belton, Tex.—Bids are asked until June 14 for constructing sanitary sewers and a sewage purification plant. J. M. Frazier, prest. Belton Sanitary Sewer Co.

Sandusky, O.—Bids are asked until June 8 for reconstructing and enlarging the lateral sewer in Washington, Hancock, Franklin and Warren sts. John Big, dir. B. P. S.

Chattanooga, Tenn.—Bids are asked until June 7 for constructing a sewerage pumping station, furnishing and installing two centrifugal pumps, electric motors, etc. H. F. Van Dusen, chm. B. P. W.

Plainfield, N. J.—Bids are asked until June 6 for constructing 4,210 ft. 8 in. vitrified pipe sewer; 11 manholes; 2 flush manholes; 150 branches; 440 ft. 4 in. vitrified pipe house connections. James MacMurray, cy. clk.

CONTRACTS AWARDED.

Rockford, Ill.—G. Maffioli was awarded a contract for constructing a sewer.

St. Petersburg, Fla.—The contract for constructing sewer No. 12 was awarded, May 6, to Overman & Hoxie.

Cincinnati, O.—The contract for constructing the Boldface sewer was awarded to McCarthy Bros., for $113,791.

Lexington, Ky.—The contract for constructing a sanitary sewer in W. Short ave. was awarded to Joseph Melvin & Co.

Moose Jaw, Sask.—Patrick Kilonny was awarded a contract for constructing 7,100 ft of sewer pipe, for $9,822.

Oshkosh, Wis.—The contract for constructing 5,585 ft. of tile sewers was awarded to J. Rasmussen & Sons Co.

Altoona, Pa.—The contracts for constructing sewer in various sections of the

city were awarded May 6 to J. P. Harney & Co., and J. L. Wilson.

Fultonville, N. Y.—The contract for constructing sewers was awarded to M. F. Dollard, of Albany, for $16,000.

Wenatchee, Wash.—The contract for constructing 6 mls. of sewer was awarded to Wetsel & Foster, of Spokane, for $227,080.

Richmond, Ind.—Maynard & Ford secured the contract for constructing a trunk sewer for Bacon's Quarter branch to Shepherd st.

Colfax, Ia.—The contract for constructing sewers was awarded to the J. W. Turner Impvt. Co., of Des Moines, for $9,400.

Manhattan, Kans.—W. W. Cook & Son, of Junction City, was awarded the contract for constructing sanitary sewer for $88,124.

Morrillton, Ark.—The contract for constructing a sewerage system was awarded to J. M. McCoppin, of Little Rock, for $15,000.

Madill, Okla.—The Tonkawa Construction Co. submitted the lowest bid, May 9, for constructing a sewerage system, at $16,051.

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Richmond, Cal.—Sewer contracts have been awarded as follows: 7th st., George W. Cushing, $15,083; Santa Fe dist., Wm. Heafey, $3,102.

Leavenworth, Kans.—The contract for constructing the main sewer and laterals was awarded to McGurrie & Stanton, for $34,954.

Montreal, Que.—The contract for constructing the last section of the Sherbrooke st. sewer was awarded to M. Dineen, for $37,072.

Woodward, Okla.—The American Light and Water Co., of Kansas City, was awarded the contract for constructing a sewerage system for $63,940.

Hays City, Kans.—The Midland Construction Co., Ft. Scott, Kans., was awarded the contract for constructing sanitary sewers, for $28,109.

Stutgart, Ark.—The contract for constructing a sewerage system was awarded to the Kress Construction Co., of Oklahoma City, for $17,130.80.

Bridgeburg, Ont.—John F. Connolly, of Toronto, was awarded the contract for constructing 10,000 lin. ft. of pipe sewers, a septic tank, etc.

Missouri Valley, Ia.—The contract for constructing a system of sewers was awarded to the Omaha Construction Co., of Omaha, Neb., as follows: 84 ft. 18-in. c. i. pipe, $4; 200 ft. 12-in., $2.25; 4,704 ft. 18-in., $1.03; 390 ft. 15-in., 77 cts.; 2,770 ft. 12-in., 57 cts; 7,774 ft. 10-in., 54 cts., and 17,534 ft. 8-in., 46 cts; 64 manholes, each $35; a bulkhead, $100, and 1,000 ft. ¾-in. galv. pipe, 25 cts.; total, $24,184.

Hays, Kans.—The contract for constructing a sewerage system was awarded to the Midland Construction Co., of Ft. Scott, Kans., for about $60,000.

Jackson, Tenn.—The contract for constructing sewers in Southeast Jackson was awarded May 10 to the Newman Sewerage Co., of Evansville, Ind., for $26,276.63.

Milwaukee, Wis.—The contract for constructing a sewer from Milwaukee and Detroit sts. to 11th ave. and Scott st. was awarded to R. J. Hickey, for $23,657.78.

Atlanta, Ga.—Sewer contracts have been awarded as follows: Lloyd st. relief sewer, 1½ mi., C. W. Lane Construction Co., $80,116; sewer in Woodward and Summit aves., Simpson and other streets, B. F. Weeks Construction and Equipment Co., $28,887.37.

Elgin, Ill.—(Special)—C. E. Plum, cy. engr., says the contract for constructing a sewer in Locust st., was awarded to Lorenson, Teteers & Joragensen, of this city.

Comstock, N. Y.—The contract for constructing a sewage disposal plant at the Great Meadow prison here was awarded to the Hudson Valley Construction Co., 30 4th st., Troy.

Springfield, Ill.—The contract for constructing sewers in 17th st. and two sections of Edwards st. was awarded to Henry Nelch & Son, at $1.25, 80 cts. and $1.10, respectively.

Baltimore, Md.—The contract for constructing the Jones' Falls interceptor, sec. No. 2, was awarded, May 11, to the United Engineering and Construction Co., of Baltimore, for $83,535.

Alliance, Neb.—The contract for constructing laterals in sewer dist. Nos. 15, 17, 18, 21, 22, 23, 26 and 33 was awarded to G. A. Dunlap, of the Inter-Mountain Bridge and Construction Co.

Atchison, Kans.—Williams & Sample have been awarded a contract for constructing a sewer in District "N," at the following bid: Plain concrete, $4,757; reinforced concrete, $44,655; lock joint, $44,910.

Angleton, Tex.—J. C. Kelso, of Galveston, was awarded the contract for constructing the Alvin drainage, at 10½ cts. a cu. yd. for dry drainage, 16½ cts. for wet, and $300 a mi. for clearing timber from the right of way.

Lorain, O.—The contract for constructing a pipe sewer was awarded to H. J. Bayter, 622 22d st., for $8,236. The Ohio Engineering Co., Elyria, secured the contract for 1,800 ft. of 48 and 36-in. concrete pipe sewer, for $9,926.

Memphis, Tenn.—The contract for constructing sewers in Klondike was awarded to the Pouncey Paving & Construction Co., of Helena, Ark., for $6,071.50. Abernthy & Garvin secured the contract for sewers in Mt. Arlington, for $6,642 57½.

WATER WORKS.

CONTEMPLATED WORK.

Hood River, Ore.—A water works system is contemplated.

Bandon, Ore.—A water works system is contemplated.

Fernie, B. C.—Voted to install a water works system.

Bangor, Me.—A new filtration plant is contemplated.

Sparta, Ga.—Voted to issue $40,000 bonds for water works.

Cairo, Ga.—Voted to issue bonds for water works extensions.

Dunkirk, O.—Voted to construct a water works system.

Orchard, Neb.—The construction of a water works system is contemplated.

Alice, via Hibbing, Minn.—A water works system is contemplated.

Onida, S. D.—Will vote on the installation of a water works system.

Beaver Dam, Wis.—The extension of the water mains has been petitioned for.

Baraboo, Wis.—Council is considering a petition to extend the water mains.

Rippey, Ia.—Voted to issue bonds for building and equipping a water works system.

New Decatur, Ala.—The Decatur Wa-

ter Works Co. contemplates installing a filter plant.

Black Diamond, Cal.—A municipal water works and electric light plant is contemplated.

Saginaw, Mich.—Will vote June 28 on the question of constructing a water works system.

Belle Fourche, S. D.—The construction of a water works system has been decided upon.

Eveleth, Minn.—The superintendent of water works has recommended the purchase of a pump.

Cottage Grove, Ore.—Bids will be asked soon for constructing a gravity water works system.

Paxton, Ill.—An ordinance has been passed to construct a 4 in. c. i. water main in W. Franklin st.

Alvin, Tex.—Voted to issue $4,000 water works bonds for improvements to the water works system.

Gaffney, S. C.—This city will expend $125,000 for water works and sewerage construction.

Mansfield, O.—A 12-in. water pipe line contemplated.

Dalton, Ga.—Voted to issue bonds for improvements and extensions to the water works system.

Canal Dover, O.—Bids will be asked soon for water-works extensions. Geo. W. Arnold, cy. engr.

Williamston, S. C.—This city will expend $20,000 for water works and sewerage systems. E. C. Horton.

Chisholm, Minn.—Improvement to the water works system is contemplated at a cost of about $40,000.

Sylvania, Ga.—Voted to issue bonds for constructing water works, electric light and sewerage systems.

Sacramento, Cal.—Mayor M. R. Beard recommends the purchase of a pump. M. J. Desmond, cy. clk.

Austin, Minn.—Bids will be asked soon for additions to the water works system. M. B. Clausen, cy. engr.

Woburn, Mass.—This city contemplates expending $20,000 this year for new water mains. Wm. B. Jones, mayor.

Boonville, Mo.—Will ask for bids in June for constructing a concrete reservoir. S. W. Reymill, cy. engr.

Donaldsonville, Ga.—Voted to issue bonds for improving the water works system and installing an electric light plant.

East Dundee, Ill.—The extension of the water mains and water works improvements are contemplated. L. R. Barrett, prest. vil.

Minneapolis, Minn.—A resolution has been passed for constructing c. i. water mains, hydrants, gates, etc. John H. Van Nest, prest. coun.

Portland, Ore.—The city auditor has been directed to ask for bids for constructing a new submerged pipe line across the Williamette river.

Imperial, Cal.—The city trustees contemplate a pipe line from the Brawley main canal to the city reservoirs for the new municipal water supply.

Nottingham, O.—Voted to issue $15,000 bonds for extending the water mains throughout that portion of the village not now supplied by the water system.

Mount Joy, Pa.—Council has decided to purchase 1,200 ft. of 4 in. pipe for the extension of the water mains in David st. and Lombard and Detweiler aves.

Conway, Ark.—Dickinson & Watkins, Southern Trust Bldg., Little Rock, have been appointed engineers for the proposed water works system. C. W. A. Wilson, secy. water bd.

Danville, Ill.—(Special)—Frank Yayne, C. E., Adams Bldg., advises us that he desires to purchase a direct-connected, automatic centrifugal pump.

Bryan, Tex.—Mayor Maloney and Aldermen Henderson and Edge have been appointed a committee to confer with Prof. J. C. Nagle, the recently elected city engineer, relative to plans for waterworks, light and sewerage systems.

CONTRACTS TO BE LET.

Athens, Tex.—Bids are asked until June 8 for constructing a water works system.

Ft. Logan H. Roots, Ark.—Bids are asked until June 6 for constructing a steel tank. Constr. Q. M.

Milford, Neb.—Bids are asked until about July 1 for constructing a water works and electric light plant.

Huntsville, Mo.—Bids are asked until June 14 for constructing a water works system. J. B. Holman, cy. clk.

Portsmouth, Ia.—Bids are asked until June 6 for constructing a steel stand pipe. Peter Harkenmath, mayor.

Havelock, Neb.—Bids are asked until June 7 for constructing water works extensions. C. A. Curie, cy. clk.

Waterbury, Conn.—Bids are asked until June 7 for constructing a storage reservoir dam. R. A. Cairns, cy. engr.

Blackduck, Minn.—Bids are asked until 8 p. m. June 2 for 1 fire underwriters' pump. D. D. Rolfe, vil, recdr.

Eldora, Ia.—Bids are asked until June 6 for furnishing 2,000 ft. 4-in. c. i. pipe. Stephen Sayer, chm. purchasing com.

Dayton, Ky.—Bids are asked until June 20 for a water works franchise for a period of 20 years. W. C. Martin, cy. clk.

Jacksonville, Fla.—Bids are asked until June 6 for constructing a covered reinforced concrete reservoir. F. R. Mowe, engr.

Corydon, Ia.—Bids are asked until June 6 for drilling an artesian well. J. J. C. Bower, town clk.; Iowa Engrg. Co., engrs.

Marshall, Minn.—Bids are asked until June 3 for digging a soft water well at the court house. Ernest S. Shepard, co. audt.

Cleveland Heights, O.—Bids are asked until June 14 for constructing a 6-in. water main in Maple road. H. H. Canfield, vil. clk.

Ft. Missoula, Mont.—Bids are asked until June 6 for constructing a water distributing system. Major A. B. Shattuck, Constr. Q. M.

Danville, Ill.—Bids are asked until June 3 for constructing a concrete dam and other water works improvements. Danville Water Co.

Rahway, N. J.—Bids are asked until June 9 for constructing 1 or more driven wells. Decatur M. Saywer, prest. N. J. Reformatory.

Boise, Idaho.—Bids are asked until July 8 for the enlargement of the main south side canal. Payette-Boise irrigation project, Reclamation Service, Boise.

Lewiston, Idaho.—Bids are asked until June 6 for constructing a 24-in. intake pipe at the city pumping station, 100 ft. into the Clearwater river. Cy clk.

Clarksburg, W. Va.—Sealed bids are asked until June 15 for constructing c. i. water pipe, valves and appurtenances and for a mechanical filter plant and appurtenances. Scott G. Highland, secy. bd. w. w. and sewerage.

CONTRACTS AWARDED.

Cherokee, Ia.—The contract for laying 3,200 ft. of c. i. water mains was awarded to Swanson & Bosworth, of Cherokee.

Albert Lea, Minn.—The contract for installing water mains was awarded to the Cook Construction Co., of Des Moines, Ia., for $2,932.

Medford, Ore.—The Jacobson-Bade Co., of Portland, Ore., was awarded the contract for constructing 6 mls. of water mains.

Tacoma, Wash.—The Anderson Construction Co. was awarded a contract for constructing water mains in the tide lands for $11,720.

O'Keene, Okla.—The contract for constructing water works system was awarded to the Southwestern Engineering Co., of Oklahoma City, for $30,000.

Utica, N. Y.—The contract for water piping for fire protection at the Utica State Hospital was awarded to John M. Holler, 452 Broadway, Albany, for $4,396.

Mont Alto, Pa.—The Pitt Construction Co., of Pittsburg, was awarded the contract May 2, for extensions to the Pa. State Mountain Sanatorium, for $19,967.

Fallstone, Md.—The contract for constructing a water works system at the Children's Fresh Air Farm was awarded to the Baltimore Cooperage Co., of Baltimore.

Willard, N. Y.—The contract for water tower and piping for fire protection at the Willard State Hospital was awarded to the Des Moines Bridge and Iron Co., of Des Moines, Ia.

Las Animas, Colo.—The contract for constructing an irrigation system for 20,000 acres adjoining Las Animas was awarded to the Kaw Construction Co., of Kansas City, Mo., for $800,000.

Boston, Mass.—(Special)—The Aberthaw Construction Co., of Boston, Mass., has been awarded the contract to erect a new reinforced concrete standpipe near the old one in Westerly, R. I. The new standpipe will be 40 feet inside diameter, nearly 100 feet from the ground to the top of the dome, and capable of holding 70 feet of water. As it is to be located in the center of the town, especial attention has been given to its architectural features.

New York City.—Bids were submitted May 11, for furnishing and constructing high pressure fire service mains and appurtenances in the Gowanus and South Brooklyn districts, as follows: Cranford Co., 52 Ninth st., Brooklyn, $497,697; Michael J. Dady, $625,042; Haggerty & Drummond, 280 Broadway, $537,338; F. V. Smith Contracting Co., $557,062; Murphy Bros., $555,217; James H. Holmes, $523,974.

Youngstown, O.—Contracts have been awarded as follows: General contract, to F. E. Dean & Co., of Youngstown, $4,789; erection of pumping station, to A. J. Serviss & Son, Youngstown, $1,656; furnishing pipe for entire system, to U. S. Cast Iron Pipe and Foundry Co., of Buffalo, $6,728; standpipe, to Tibbett & Wood, of Philipsburg, N. J., $2,891; hydrant, valves and valve boxes, to Darling Pump Mfg. Co., of Williamsport, Pa., $1,225.

Beau Bridge, La.—Contracts for constructing a water works system were awarded, May 3, as follows: To U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, New York, pipe, $28.30 per ton, specials, $55; the Fairbanks Co., valves and hydrants; the R. D. Cole Mfg. Co., Newman, Ga., tower and tank, $3,595; Platt Iron Works Co., Dayton, Ohio, pump and boiler feeders, $1,534; Walsh & Weidner Boiler Co., Chattanooga, Tenn., boilers and steel setting, $1,769; Ahrens & Ott Mfg. Co., New Orleans, La., lead, hemp and general supplies.

BRIDGES.

Troy, O.—Bids are asked until June 8 for constructing bridges. A. E. Sinks, co. audt.

Stronghurst, Ill.—Bids are asked until June 4 for building 3 bridges. P. A. Stamp, twp. clk.

Philadelphia, Pa.—The business men of West Philadelphia advocate a larger bridge at Chestnut st.

Port Angeles, Wash.—Bids are asked until June 3 for building a bridge across Moose creek. Co. audt.

Greencastle Ind.—Bids are asked until June 6 for constructing 4 bridges. D. V. Moffett, co. audt.

Valparaiso, Ind.—Bids are asked until June 7 for constructing 2 bridges. G. F. Stinchfield, engr.

Chehalis, Wash.—Bids are asked until June 4 for constructing 2 steel bridges. H. H. Snofford, co. audt

La Salle, Ill.—Bids are asked until June 13 for constructing a concrete arch. E. Bryne, cy. engr.

Newport, Ind.—Bids are asked until June 6 for building a steel girder bridge. H. T. Payne, co. audt.

Tunica, Miss.—Bids are asked until June 6 for constructing culverts. F. L. Hose, clk. bd. co. supvrs.

Shelbyville, Ind.—Bids are asked until June 7 for constructing bridges and bridge repair. C. W. Huntington, co. audt.

Jeffersonville, Ind.—Bids are asked until June 6 for constructing a bridge over Logan creek. Peter Nachaud, co. audt.

Crookston, Minn.—Bids will be called for in June for the construction of 11 new bridges this summer. Co. audt.

Colfax, Wash.—Bids are asked until June 7 for constructing a number of bridges. Wm. M. Duncan, co. audt.

Portland, Ore.—The construction of a bridge over the Willamette river is urged by the South Portland Club.

Smithfield, N. C.—Bids are asked until June 6 for building an iron bridge. Sam T. Honeycutt, clk. co. comrs.

Madison, Ind.—Bids are asked until June 7 for constructing and repairing bridges. G. F. Crozier, co. audt.

Warren, O.—Bids are asked until June 6 for constructing a bridge over Grand river. Fred Stone, co. audt.

Farmington, Mo.—Bids are asked until June 20 for constructing a steel bridge over Blue river. C. H. Troy, co. audt.

Idaho Falls, Idaho.—Bids are asked until July 11 for constructing 2 wagon bridges across Big Lost river. Co. comrs.

Brookville, Ind.—Bids are asked until June 1 for constructing concrete arches and fills. Chas. A. Miller, co. audt.

New Castle, Ind.—Bids are asked until June 16 for constructing arches, culverts and bridges. W. L. Risk, co. audt.

Stevenson, Wash.—Bids are asked until July 5 for building a bridge over Little White Salmon river. Bd. co. comrs.

Kirkwood, N. Y.—Voted to appropriate $500 for constructing a bridge across the Susquehanna river between this town and Conklin.

Charlestown, W. Va.—The estimated cost of constructing a bridge over the Kanawha river is $95,000 to $125,000. Cy. council.

Grand Rapids, Mich.—Bids are asked until June 3 for repairs to piers at Pentwater, Mich. C. S. Ricke, major U. S. Engrs.

Hammond, Ind.—Bids are asked until June 7 for constructing 6 new bridges and a concrete arch. Chas. A. Johnson, co. audt.

Jackson, Mich.—Bids are asked until June 6 for constructing a concrete or steel bridge over Grand river. A. W. Hall, cy. engr.

Brazil, Ind.—Bids are asked until June 6 for constructing 2 concrete bridges and 1 steel bridge. Jas. L. Brown, co. audt.

Cheyenne, Wyo.—Bids are asked until June 8 for constructing a wood and timber bridge over Pole creek. C. Edward Artist, co. clk.

Winnipeg, Man.—Bids are asked until June 28 for constructing concrete piers and a steel bridge. M. Peterson, secy. bd. control.

Ft. Sill, Okla.—Bids are asked until June 10 for constructing a steel highway bridge Cache creek. Capt. David L. Stone, constr. Q. M.

Concully, Wash.—Bids are asked until June 7 for constructing a steel and wood bridge over Similkameen river at Nighthawk. Co. comrs.

Crown Point, Ind.—Bids are asked until June 6 for constructing a steel bridge across Grand Calumet river. Chas. A. Johnson, co. audt.

Vicksburg, Miss.—Bids are asked until June 7 for constructing a wooden bridge or aprons in Red Bone bottom. J. D. Laughlin, clk. co. bd. supvrs.

St. Louis, Mo.—Bids are asked until June 21 for constructing foundation and concrete work for concrete viaduct on Kings highway, from Manchester to McKee ave. Maxime Reber, prest. B. P. I.

Taylors Falls, Minn.—Bids are asked until June 3 for constructing a steel bridge across St. Croix river, between St. Croix Falls and this village. Bd. vil. trustees of St. Croix Falls; vil. coun. Taylors Falls.

Lafayette, Ind.—Bids are asked until June 8 for constructing a steel bridge across Burnett's creek at Battle Ground and for the repair of the old stone abutments; for a concrete flat top bridge across Little Flint creek. John P. Foresman, co. audt.

STREET LIGHTING.

Terre Haute, Ind.—The Citizens Gas. Co. contemplates enlarging its plant.

Palmyra, Mo.—Voted to issue $15,000 bonds to acquire or construct an electric light plant.

Camrose, Alta.—Plants for a municipal electric light plant will be prepared by M. A. Maxwell, of Boston.

Owensville, Ind.—Plans have been authorized for improving and extending the central electric light plant.

Macon, Miss.—The city council contemplates enlarging and improving the municipal electric light plant.

Cairo, Ga.—Voted to issue bonds for improvements to the electric light system. J. M. McNair, cy. clk.

Ft. Andrews, Mass.—Bids are asked until June 6 for constructing an electric light system. A. M. Miller, constr. Q. M.

Savannah, Mo.—Bids are asked until June 15 for constructing an electric light plant. F. C. Barington, St. Joseph, Mo.

Ft. McKinley, Me.—Bids are asked until June 2 for remodeling the electric light system here. Capt. C. F. Humphrey, constr. Q. M.

Elkton, Md.—Plans for constructing an electric power plant are being considered by the Elkton, Fair Hill and Oxford Electric Ry. Co.

West Palen Beach, Fla.—Bids are asked until July 1 for constructing an electric light plant. G. W. Jonas, secy. West Palen Beach Impvt. Co.

Bedford, Ind.—The White River Power Co. has been incorporated to deal in electric current, by John T. Freeland, John M. Monical and Milt Myers.

Sullivan, Ind.—The Sullivan Electric Co. has approved plans and bids will be received for remodeling a large warehouse into an electric light and power plant.

New Market, Ind.—The New Market Light Co. has been incorporated to conduct light, heat and power business, by W. V. Yount, W. J. Miles and L. B. Etter.

Old Town, Me.—A special committee has been appointed to inquire into the feasibility of establishing a municipal electric light plant. Wm. H. Waterhouse, McLeod Bldg.

Victoria, B. C.—Bids are asked until June 6 for constructing a transmission line for furnishing electricity to the hospital for the insane at Coquitlam. Minister Pub. Wks.

Cisco, Utah.—Bids are asked until June 30 for constructing a power plant for irrigation purposes for the Grand Valley Fruit and Water Co. to be constructed here. Hampson-Fielding Engrg. Co., Engrs., Denver, Colo.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Rock Island, Ill.—The purchase of a street sprinkler is contemplated.

Toledo, O.—Bids are asked until June 10 for the disposal of garbage. Dir. pub. service.

Rochester, N. Y.—The question of constructing a crematory for the disposal of rubbish is contemplated.

White Plains, N. Y.—Bids are asked until June 6 for collecting garbage for 1 year. John J. Brown, prest. town trustees.

PARKS.

Kansas City, Mo.—Arleta Park is to be enlarged.

Boston, Mass.—Marine Park, in South Boston, is to be improved and beautified.

Bloomfield, N. J.—The establishment of a park in the 2nd ward is contemplated.

Augusta, Ga.—May Park is to be restored to its former state of beautiful usefulness.

FIRE APPARATUS.

Hillyard, Wash.—The city clerk has been directed to ask for bids for a fire alarm system.

Eveleth, Minn.—Bids are asked until June 7 for 200 ft. 2½-in. rubber lined fire hose. D. P. McIntyre, cy. clk.

Virginia, Minn.—Bids are asked until June 6 for 1,000 ft. of 2½-in. cotton rubber lined hose. Albert E. Bickford, secy. police and fire comm.

St. Paul, Minn.—Bids are asked until June 14 for purchasing a 2nd size steam fire engine. The chief engineer recommends the purchase of a combination hose wagon. Wm. O'Gownan, secy. fire bd.

Montgomery, Ala.—Bids are asked until June 6 for 2 steam fire engines, Nos. 1 and 2; 2 combination chemical and auto hose cars; 600 ft. 2½-in. rubber and cotton hose. Robt. Tait, cy. treas.